BONNIE AND CLYDE P. 12 • GROWING OLD UNGRACEFULLY P. 104

Smithsonian

APRIL 2009

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Who Owns America's Fossils?

ALSO:

ISFAHAN'S FADED GLORY

COOK VS. PEARY

FORENSIC ASTRONOMER

RED HOT CHILI PEPPERS

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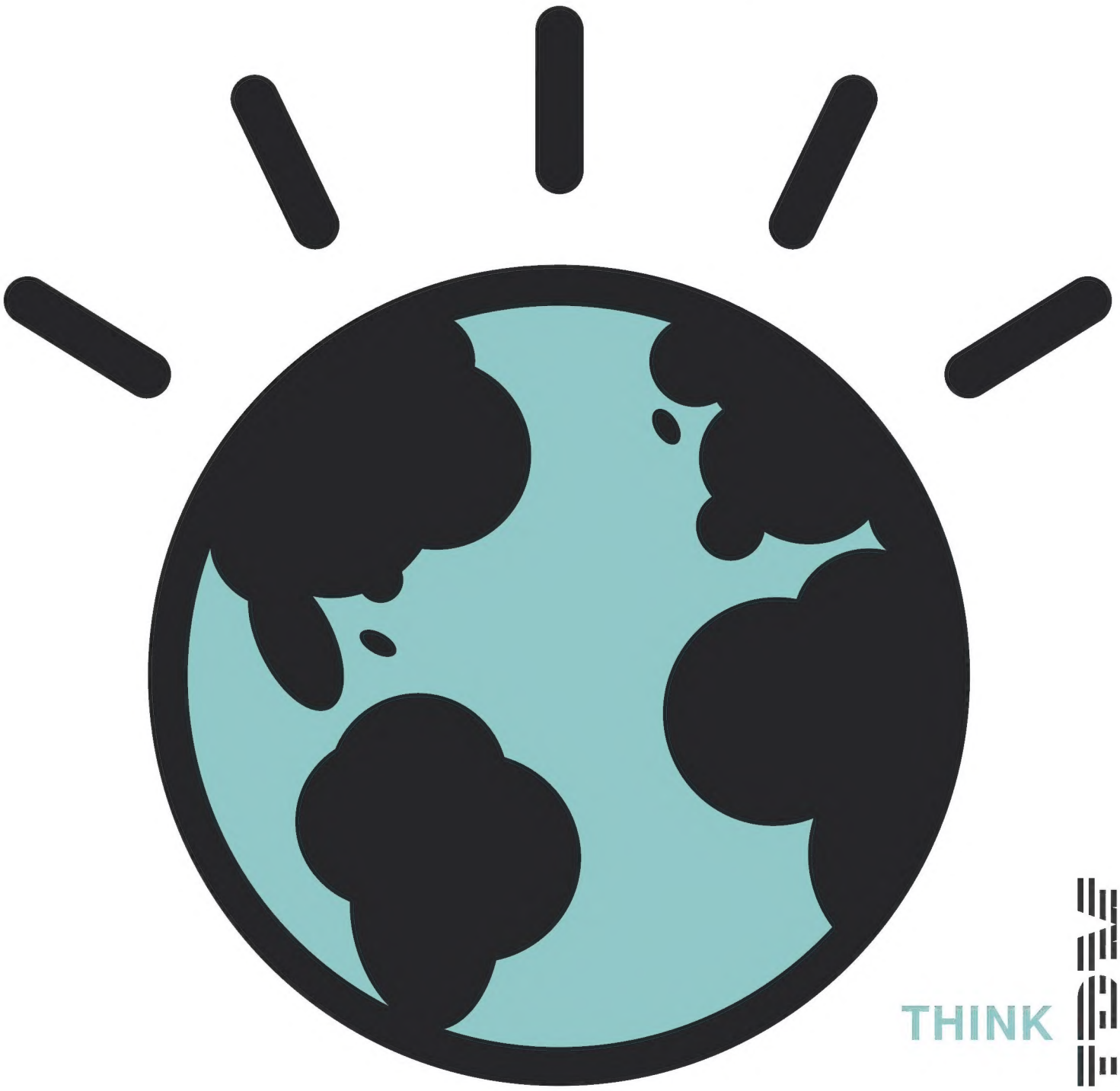

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When these mosaics were still vibrant, Isfahan was more cosmopolitan than Paris, and grander, some say, than even storied Istanbul.

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PHOTOGRAPH BY LOUIE PSIHOYOS

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PHOTOGRAPH BY GHAITH ABDUL-AHAD / REPORTAGE BY GETTY IMAGES

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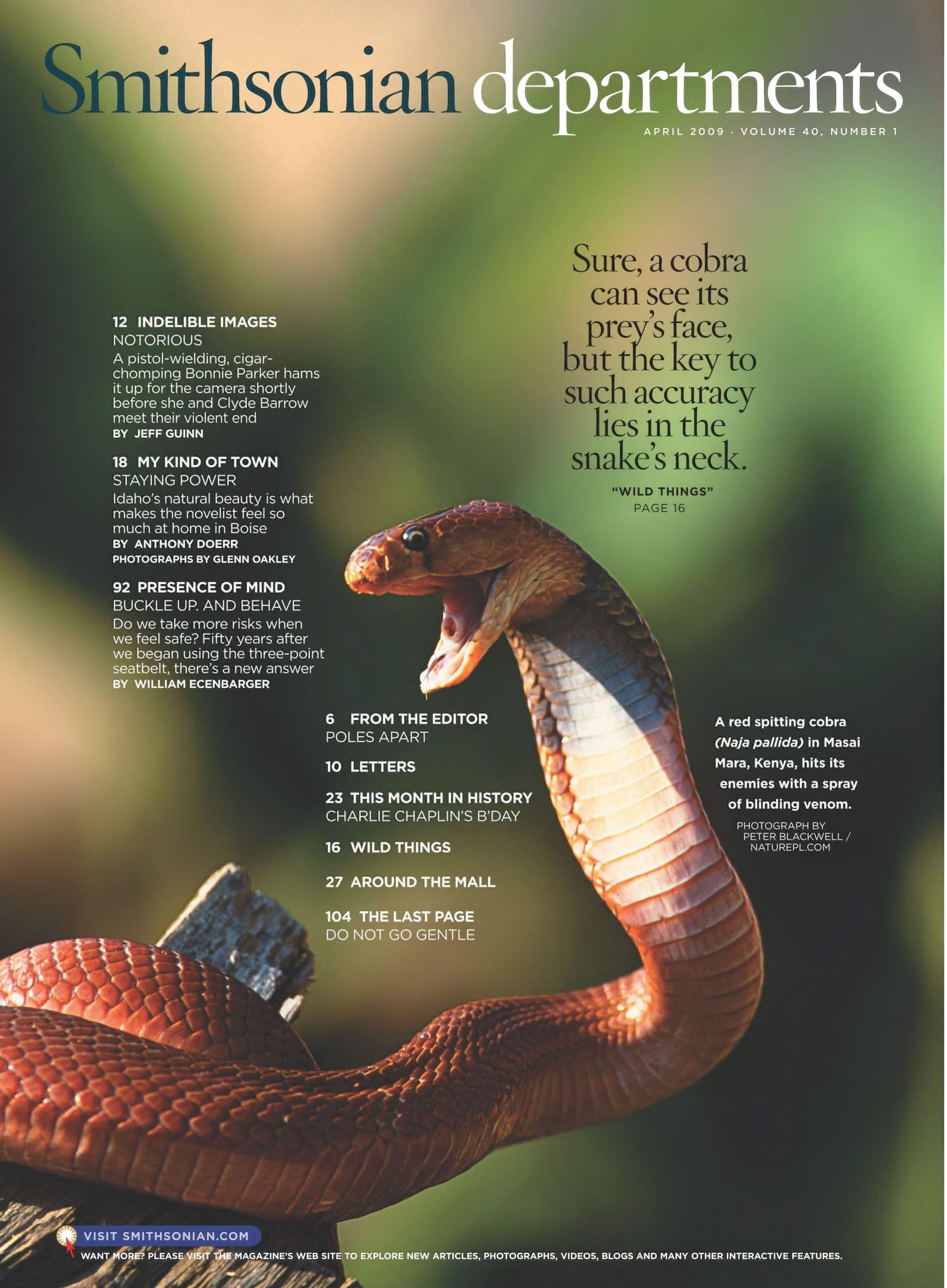

A red spitting cobra *(Naja pallida)* in Masai Mara, Kenya, hits its enemies with a spray of blinding venom.

PHOTOGRAPH BY PETER BLACKWELL / NATUREPL.COM

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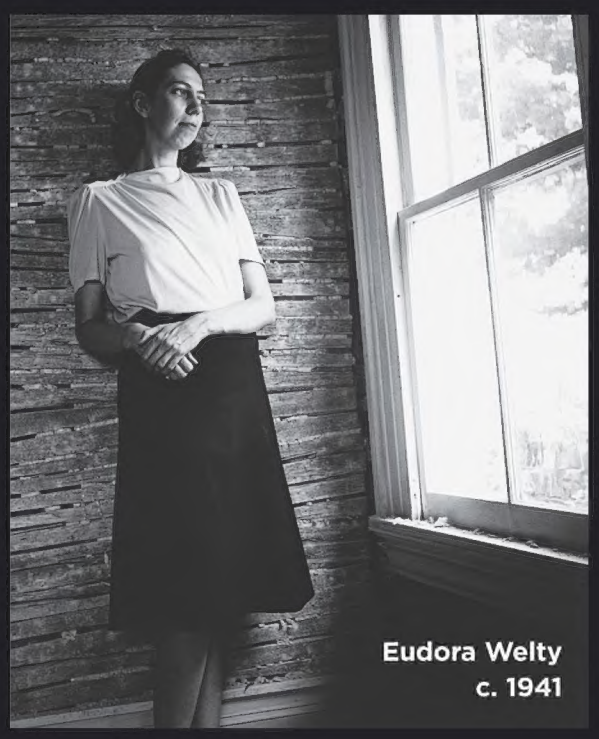

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Eudora Welty
c. 1941

FROM THE EDITOR

Poles Apart

Fossil rights and historical wrongs

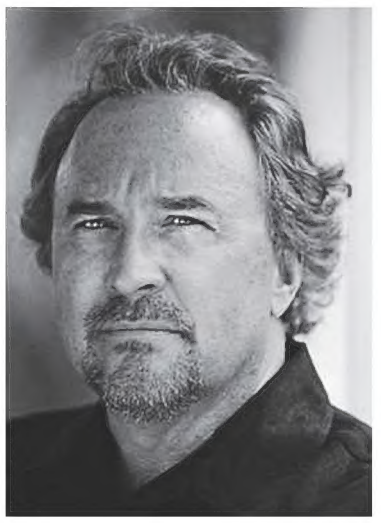
BY CAREY WINFREY

DONOVAN WEBSTER SPENT 18 MONTHS, on and off, investigating the growing problem of dinosaur prospecting—private citizens digging up dinosaur bones and other fossils to sell them—which has paleontologists in an uproar and the legal system in a tizzy ("The Dino Wars," p. 48). It would seem obvious that if a fossil "is significant, it should be in a museum," Webster says, but he discovered that laws about digging vary from jurisdiction to jurisdiction, and "are so carved up depending on where you find the thing"—on public or private land—"even the paleontologists can't agree on what it is we need to protect the significant fossils." The case Webster tracks, which involves a rare juvenile *Tyrannosaurus rex* skeleton first thought to be on private land but later determined to be on county property, exemplifies the complexities. "At some point we are going to have to have a national dialogue about these questions," says Webster. "These fossils belong to all of us. Somebody's making private money off them. What should we do about it?"

Webster: What should we do?

"HISTORY ISN'T ALWAYS PORTRAYED ACCURATELY," says Bruce Henderson, author of *True North: Peary, Cook, and the Race to the Pole*, from which he adapted "Cook vs. Peary," page 58. "History books and encyclopedias have long said that Robert Peary discovered the North Pole, in 1909. Guess what? The claim of Frederick Cook to have gotten there a year before Peary is every bit as strong, and in some ways stronger, because Cook was the first to come out with original descriptions of the pole, before Peary would release his own descriptions. And this was at a time when people didn't know if there was land up there or even a lost civilization. Cook described the pole in a way that was verified by all the people who came after him. That's an amazing thing. So just because it's reported to be history doesn't make it right." For his book on the pair, Henderson spent nearly two years doing research at the National Archives, the Library of Congress and the Byrd Polar Research Center at Ohio State University, reading the explorers' letters and journals as well as a host of related documents. "There's going to be a lot of stories about the centennial of the discovery of the North Pole by Robert Peary. I'd love for readers to know, wait a minute, maybe another guy got there first. Maybe this is actually the 101st anniversary of the discovery. How is it that the forces around Peary completely overwhelmed Dr. Cook? How is it that Cook has basically dropped out of our history books?"

Henderson: Guess what?



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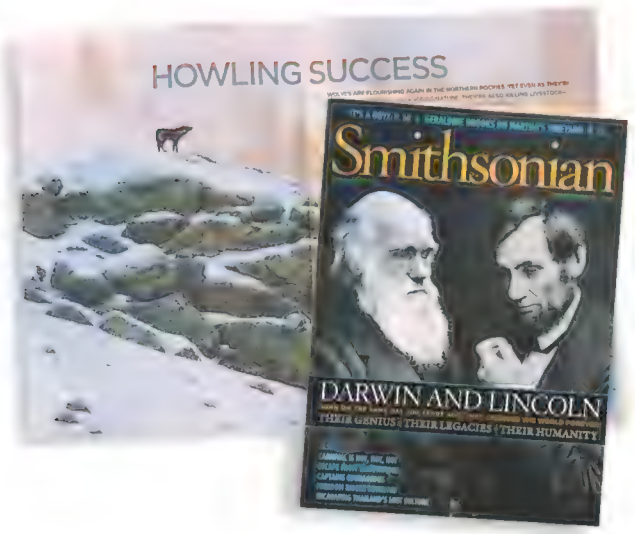

A rancher states that wolves that "misbehave" may be killed ["Howling Success"]. But wolves neither behave nor misbehave–they try to survive wherever they happen to be. Wolves have a rightful place in the Rockies. Ranchers who graze their cattle on public land should accept some losses in return. **KRISTINE PATRICK,** MADRAS, OREGON

WHAT PRICE SUCCESS?

I APPRECIATE the effort Mr. Clifford took to present both sides of the argument about the transplanting of Canadian wolves into Yellowstone. Some may consider it a "howling success," but I consider it a tragedy—for the stockmen, for the game herds that have never had to deal with wolf packs before, even for pet owners. But most of all it has been a tragedy for the wolves. They were chased and darted in their own domain, transported to a strange land and turned loose to fend for themselves, only to be shot for killing the "wrong" animals. Did people honestly think wild wolves could be trained not to kill the "wrong" animals?

E. A. JOHNSON
BUTTE, MONTANA

TWIN PIQUES

THE ONLY place Darwin and Lincoln are equals is in the mind of author Adam Gopnik ["Twin Peaks"]. What a stretch to weave their lives together because they share a birthday. "High peaks [that] look out toward each other"? Total hyperbole.

RICK MUNSELL
THE VILLAGES, FLORIDA

YOUR FEBRUARY issue was excellent, and best of all, in my estimation, was Adam Gopnik's thoughtful and eloquent summing-up of Darwin and Lincoln. In my 40 years as a historical editor, I have seldom if ever finished reading an essay with tears in my eyes, as I did this time.

PAUL HASS
MADISON, WISCONSIN

BELATED PRAISE

DARWIN, DESERVEDLY, receives praise ["What Darwin Didn't Know"], while author Thomas Hayden states that Jean-Baptiste Lamarck's competing theory of evolution "became a textbook example of shoddy thinking." Obviously, Lamarck got it wrong, but shoddy thinking? This year marks the 200th anniversary of the publication of his *Philosophie Zoologique*, the great work that everyone loves to hate. The bad press that he suffered probably originated with the French naturalist Baron Cuvier, who allegedly composed a eulogy on Lamarck's death in 1829 that was so mean-spirited it was not made public until Cuvier himself died in 1832. Its negative spirit lives on, but let's pay heed to Darwin's own sentiment on Lamarck, expressed on the first pages of *Origin of the Species*: "This justly celebrated naturalist . . . first did the eminent service of arousing attention to the probability of all change in the organic, as well as in the inorganic world, being the result of law, and not of miraculous interposition."

W. REUBEN KAUFMAN
EDMONTON, ALBERTA, CANADA

FAMILY OF MAN?

I'M GRIMLY amused that the photograph featured in "Special Delivery," which shows the photographer's newly delivered son, was selected for inclusion in the 1955 *Family of Man* exhibition and was later selected to be carried aboard the Voyager spacecraft representing, simply, "Birth." This photograph offers an image of birth in which a male obstetrician appears to have conjured a human infant out of nothing. The woman who has carried it for nine months, labored for hours and finally forced it out of her body is nowhere to be seen. Imagine the astonishment of putative space aliens who glimpse the Voyager payload and later visit our planet and discover how it is really done.

KAREN E. MURRAY
ARLINGTON, VIRGINIA

HORSE SENSE

I WAS INDEED amazed by the University of Sussex study that demonstrated a horse can recognize a herdmate's neigh ["Wild Things"]—amazed that a study was needed to prove what any observer of horses knows. Horses recognize people by their voices, too. They can also distinguish other noises, as demonstrated at boarding stables where the only horse that reacts to the sound of an approaching vehicle is the one whose owner is arriving. For anyone interested in equine behavior, I recommend the writing of two astute observers who spent their lives working with horses, Will James (*Horses I've Known)* and Margaret Cabell Self (*The Nature of the Horse)*.

LYNN ACTON
BERKSHIRE, NEW YORK

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Notorious

Bonnie Parker and Clyde Barrow liked posing for pictures—much to the satisfaction of the Joplin, Missouri, police **BY JEFF GUINN**

CLYDE BARROW AND BONNIE PARKER began 1933 on what for them passed as a high note. They'd been fugitives for months as Clyde and some accomplices robbed and shot their way around Dallas and environs, and Clyde had barely escaped a police ambush at a friend's West Dallas home. But after he got away (killing a sheriff's deputy in the process), he and Bonnie spent three months roaming Oklahoma, Arkansas and Missouri, with their partner W.D. Jones, anonymous and unhurried.

This period came closest to the carefree criminal life the couple had envisioned after Clyde was paroled from a Texas prison farm in February 1932. Unbothered by any organized pursuit, they meandered from town to town, stealing cash and food as needed. They ate by the roadside or in the privacy of rented rooms. Bonnie felt safe enough to forgo flat shoes (easier to run in) for the high heels she preferred.

Later on, Clyde's sister Marie would muse that during these months the members of the so-called Barrow Gang wielded a screwdriver more often than they did their guns. They used the tool to change license plates to evade identification on the cars they stole. Clyde drove; Bonnie navigated. W.D. was often called on to act as photographer.

Clyde and Bonnie loved posing for pictures. Sometimes they'd strike the same sort of silly poses they'd assumed in a more innocent time in the amusement park photo booths back in Dallas (when the guns they waved were toys). One photograph W.D. snapped showed Bonnie posing with a gun in her hand and a cigar clenched in her teeth. "Bonnie smoked cigarettes, but . . . I gave her my cigar to hold," he would later say.

At that moment, the notoriety of the Barrow Gang was concentrated in Texas, with faint radiations into select parts of New Mexico and Oklahoma. That would soon change.

On April 13, 1933, police in Joplin, Missouri, raided an apartment in that town in the belief they would find some bootleggers there. (Prohibition wasn't quite over in Missouri; beer was legal, spirits weren't.) Instead, they found Clyde, Bonnie and W.D., along with Clyde's brother Buck and sister-in-law Blanche, who had met up with the others after Buck's own release from prison.

A firefight broke out. Two police officers were shot dead. Although W.D. took a bullet in the side (from which he would recover), all five members of the Barrow traveling party escaped. Clyde drove them to Shamrock, Texas, covering almost 600 miles overnight. They had only the smoking guns and the clothes on their backs.

Back at the Joplin apartment, police discovered a camera and some rolls of undeveloped film. After processing, the film yielded a series of prints depicting all five fugitives. The one of Bonnie with the gun and the cigar was among several the *Joplin Globe* published just two days after the raid—then sent out over the wires.

The Joplin photographs introduced the nation to new criminal superstars. Of course there were others—Al Capone, Ma Barker, John Dillinger, Pretty Boy Floyd—but in Clyde and Bonnie the public had something new to ponder: the idea of illicit sex. The pair were young and traveling together without benefit of marriage. And while ladies smoked cigarettes, this gal smoked a *cigar*, Freudian implications and all.

Articles on the pair soon appeared in such magazines as *True Detective Mysteries*. The newsreels weren't far behind. Bonnie and Clyde were on their way to becoming folk heroes to a Depression-weary public. "Even if you did not approve of them," recalls Jim Wright, the former speaker of the House of Representatives who grew up in Texas and Oklahoma at the time, "you still would have to envy them a little, to be so good-looking and rich and happy."

But the couple's final 13 months belied their new image. They spent the time in the company of a shifting cast of

Adapted from *Go Down Together*, by Jeff Guinn. Copyright © 2009 by Jeff Guinn. Reprinted by permission of Simon & Schuster Inc., New York.

BETTMANN / CORBIS

"That cigar bit [that] folks like to tell about is phony," said W.D. Jones, whose photograph of Bonnie was seized in a police raid.

Bonnie and Clyde (left: in a photograph inscribed by the owner of the stolen automobile behind them) met their bloody end in a police ambush in Louisiana 75 years ago. An entrepreneur put the car in which they were killed on the carnival circuit (above).

thugs. (They eventually parted ways with W.D., who that November went to prison for killing a sheriff's deputy.) They robbed small-town banks and mom-and-pop stores, or tried to. They sometimes broke into gum ball machines for meal money. Their celebrity had made them the target of lawmen across the Mid- and Southwest.

In February 1934, authorities in the Lone Star State hired former Texas Ranger Frank Hamer to track them down, and with information from a Barrow Gang member's family, he did just that. Clyde and Bonnie were alone together on May 23, 1934, 75 years ago next month, when they drove a stolen Ford sedan into a spectacularly fatal police fusillade outside Gibsland, Louisiana. He was 24, she 23.

The allure of their image outlived them. A crowd of 10,000 overran the funeral home where Clyde's body was laid out; twice as many, in the estimate of Bonnie's mother, filed past her casket. Afterward, an entrepreneur bought the bullet-riddled Ford and toured it for years, into the early '40s. People lined up to see it.

JEFF GUINN, *a former investigative reporter for the* Fort Worth Star-Telegram, *has written 14 fiction and nonfiction books.*

BUDDY BARROW COLLECTION; NATIONAL MUSEUM OF CRIME AND PUNISHMENT

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There at every turn.®

WILD THINGS

LIFE AS WE KNOW IT

BY JOSEPH CAPUTO, T.A. FRAIL, MEGAN GAMBINO, ABIGAIL TUCKER AND SARAH ZIELINSKI

A WOLF IN DOG'S CLOTHING

Wolves come in gray, white and, in North America, black. Where did those unusual black coats originate? Scientists from Stanford University and elsewhere compared the DNA of wolves from the Canadian Arctic and Yellowstone National Park with the DNA of coyotes and dogs. The black coat gene, the researchers found, appears to have come from dogs. Some North American wolves likely interbred with domesticated dogs, now extinct, that accompanied people who crossed the Bering Strait from Asia more than 10,000 years ago.

PROTO WHALE

Newly analyzed 47.5-million-year-old fossils from Pakistan are yielding fresh insights into the early ancestors of modern whales. *Maiacetus inuus* (above: illustration) was a land animal highly adapted to life in the sea. One fossil encased a fetus positioned for a head-first delivery, which is typical of a land mammal and suggests the species gave birth onshore. But it probably spent most of its time in the water: its big teeth were suited for catching fish and its flipper-like feet couldn't have been great for walking.

HOW FISH RECYCLE

So, how many fish *are* in the sea? Scientists led by the University of Exeter in England have a new answer: about two billion tons. The estimate comes from a study of how ocean fish absorb dissolved calcium and convert it into calcium carbonate, which they dispose of in granules called "gut rocks." Snails, crabs and other creatures build shells out of the fish excretions.

SLEEP IT OFF

Slugabeds, take heart: researchers in Norway and Finland found that animals that hibernate or hide are less likely than other species to be listed by the World Conservation Union as endangered or threatened. Nestling in burrows (below: the common dormouse), tree holes or caves conserves energy and may buffer these species against environmental change.

Observed

NAME: Spitting cobras, snakes in the genus *Naja*.
EVIL EYE: They spit a blinding venom at prey up to six feet away.
BULL'S EYE: In a study of spitting accuracy, one species hit its target 80 percent of the time and another never missed.
SNAKE EYES? Sure, a cobra can see its prey's face, but the key lies in the snake's neck, according to a new study out of the University of Bonn in Germany. A striking snake shakes and twists its head, dispersing venom in a pattern that makes the drops almost impossible to avoid. The researchers, though, worked behind glass.

JIM AND JAMIE DUTCHER / NGS IMAGE COLLECTION; JOHN KLAUSMEYER, UNIVERSITY OF MICHIGAN MUSEUMS OF NATURAL HISTORY; CHRIS NEWBERT / MINDEN PICTURES; GEORGE MCCARTHY / NATUREPL.COM; MICHAEL RICHARDS / JOHN DOWNER / NATUREPL.COM

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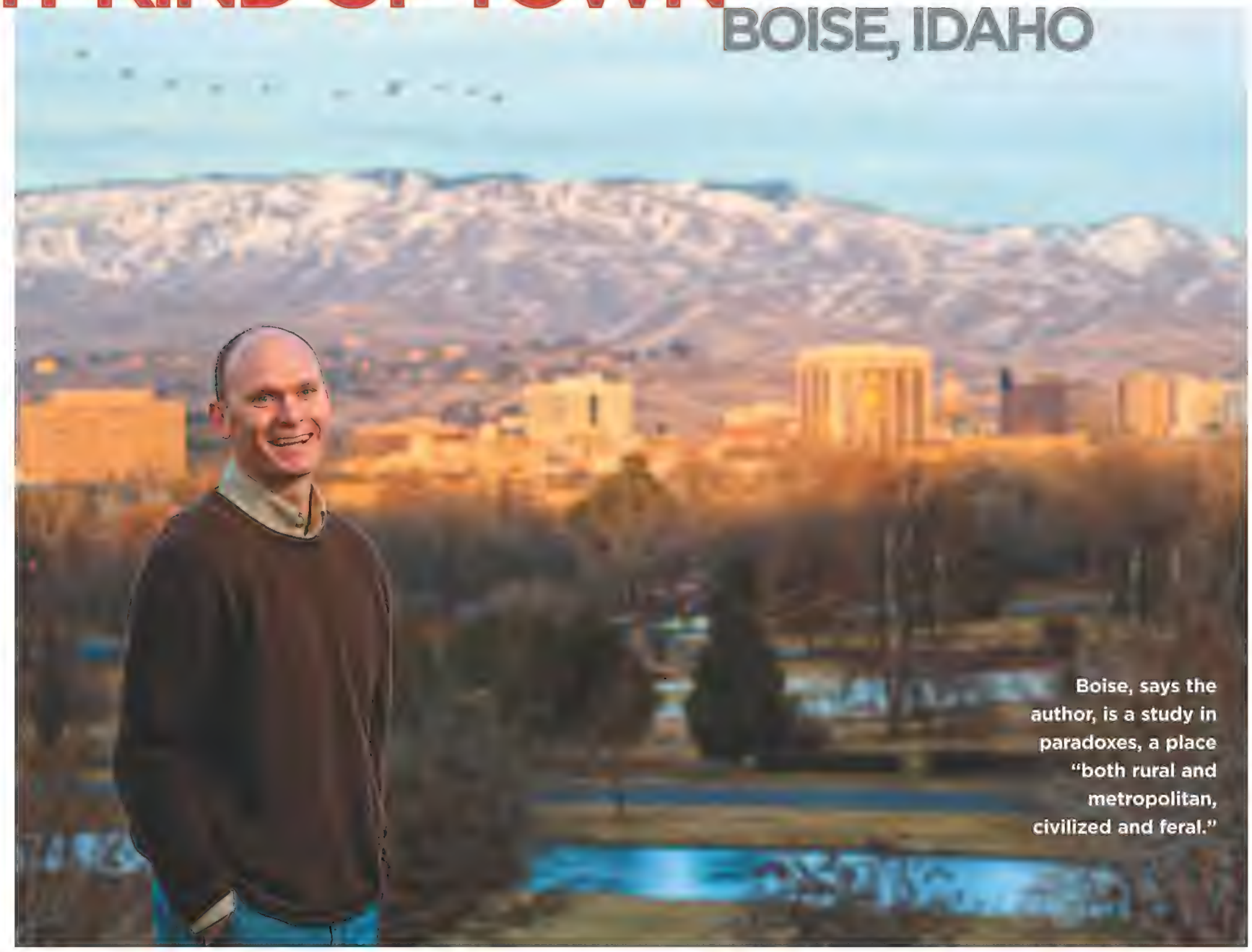
MY KIND OF TOWN

BOISE, IDAHO



Boise, says the author, is a study in paradoxes, a place "both rural and metropolitan, civilized and feral."

Staying Power

Big skies and colorful characters bind the versatile writer to his adopted home

BY ANTHONY DOERR PHOTOGRAPHS BY GLENN OAKLEY

I **STAND AT THE WINDOW,** 7 in the morning, and watch snow drift across the backyard. Dawn is slow and pale. I drive my 4-year-old twin sons to preschool. The sky swirls; the roads are ribbons of slush. Fog washes between the upper stories of downtown Boise's few tall buildings.

We are passing the Hollywood Video at Broadway and Park when a doe comes skittering onto the road. The intersection is six lanes across and the Toyota in front of us flares its brake lights and 40 or 50 cars in all directions follow suit. We slide into a dangerous, slow-motion ballet. Behind the first doe come five more, radar-eared, panicky, dancing across the centerline.

A truck beside us grinds up onto the curb. A dozen cars behind us glide to a stop. No one, miraculously, appears to have crashed into anyone else.

My sons yell, "Deers, deers!" The six does reach the far side of Broadway and make several dazzling leaps into Julia Davis Park, the oldest of the string of city parks woven through the center of Boise. The deer pause for a moment, looking back, twitching their ears, exhaling vapor. Then they melt into the trees.

I breathe. The traffic realigns and creeps forward again.

BOISE, contrary to the notions of Easterners I meet now and then, is not located in Indiana, Ohio or Iowa. More than 300 miles from Salt Lake City and 400 miles from Reno and Portland, Boise, Idaho, is arguably the most remote urban area in the Lower 48. The broad, sandy flood

plain on which it is built forms an island in what some people still call the Sagebrush Ocean, thousands of square miles of balsamroot, sky and stillness in the Far West. Depending on the weather, Boise looks alternately silver or gold or beige or purple; after rain, it smells like menthol.

Boisé: in French it means wooded. Our nickname has long been the City of Trees, which sounds absurd to most visitors from, say, Indiana, Ohio or Iowa, whose towns' most pedestrian hardwoods dwarf all but Boise's biggest and oldest oaks. It's only when you approach the city by road, or better yet on foot, that you begin to understand how the appellations suit the place, how a thin belt of cottonwoods along a river might have looked almost supernaturally desirable to a traveler after hundreds of miles of unremitting high desert.

Imagine you're plodding through the summer of 1863, the year the city was founded. You're tired, you're thirsty, you've been passing for weeks through mountains that belong primarily to wildlife: grasshoppers the size of thumbs, anthills the size of pitchers' mounds, biblical herds of pronghorns raising dust clouds in the distance. Reefs of purple clouds gather above the horizon and the day's heat pumps off the basalt around you, and you come over a last bench to see a valley shimmering like some fabled oasis below you: a few orchards, a smattering of buildings, the silver braids of the Boise River. The 19th-century writer Mary Hallock Foote deemed Boise "the metropolis of the desert plains, the heaven of old teamsters and stage drivers crawling in at nightfall," and it's easy enough to picture. A few lights burn between the trees; a half-dozen spires of smoke rise into the dusk. The promise of rest, drink, shade—a haven, a refuge, a city of trees.

These days I can pedal past the densely built bungalows, Queen Annes and Tudor Revivals of Boise's North End into the 30 or so blocks that make up downtown Boise and eat dumplings made by Thai immigrants, buy a pair of jeans made in Guatemala and watch a Pedro Almodóvar film at an art house. Steeples rise here and there; the statehouse dome looms grandly against the backdrop of the foothills. Spend enough time in the hills, a friend who lived for several years in the Bitterroot Mountains told me, and Boise begins to feel like Paris.

But our city remains a place where we see moose tracks on the bike trails and bald eagles along the river and—once, in front of our neighbor's house—cougar prints in the snow. A dozen miles from my house I can stand in the foothills and experience the same graveyard quiet, the same desert indifference that trappers and the Shoshone and Bannock Indians knew. And beyond the foothills are lakes marked on maps only by their elevations, velvet hillsides, alpine meadows, ice caves, lava fields, roaming wolves, a last few herds of bighorn sheep. An hour from our driveway wild kokanee salmon still spawn in the creeks and migratory bull trout still grow to 20 pounds.

This is not to suggest that Boise is a citadel encircled by wilderness. Our exurbia continues to distend, and with this comes cheat grass, air pollution and gridlock. The grizzlies are gone, the chinook salmon have to be trucked past dams, and every year the deer and elk find more winter rangeland transformed into subdivisions. Like most Americans, we fertilize our lawns, erect our vinyl fences and chlorinate our swimming pools. We forget, most of the time, about our wilder neighbors, the creatures that live out on the cloud-swept, corrugated watershed beyond our cul-de-sacs.

BUT EVERY FEW DAYS a half-dozen mule deer scramble across a downtown intersection, or a fox steals a garden glove from the backyard, or a pair of sandhill cranes land in the marsh behind a steakhouse and remind us where we live. In those moments the paradox that is Boise strikes deeply and keenly: it is a place both rural and metropolitan, civilized and feral. It's a town full of settlers and wanderers, conservationists and conservatives, hippies and hunters, folks who value both snowmobiles and tiramisu, who clean their shotguns one evening and donate to the Shakespeare Festival the next.

I have a friend who sells commercial roofing and is so adept at fly-fishing he can stand 50 feet up on a cutbank and identify the shapes of brown trout holding among weeds on the bottom of a surly river. Another friend trades commodities all day but wanders off alone into the Pioneer Mountains every October with a bow and a bottle of elk urine

Dubbed "the metropolis of the desert plains" in the 19th century, Boise (above left: c. 1909) provided a place of refuge for those traveling to America's West. Today, the city offers an array of urban attractions (above right: Zeppole Baking Company).

LEFT: LIBRARY OF CONGRESS

to use as an attractant. And I know a real estate developer who's so skilled on telemark skis you can hardly believe he isn't an Olympic athlete; he'll slip down the backside of a ridge and a curtain of powder will rise up over his head, and beneath the snow his entire body will have transformed itself into a fluid, white submarine flowing between the trees.

Boise is a place with a long human history—the Bannocks, the Shoshones and older tribes, too. Not far from here, in Buhl, Idaho, the 11,000-year-old skeleton of a woman turned up in a quarry, some of the oldest human remains that have been found in North America. There are pictographs in our hills and bones in our caves. Ghosts are everywhere, wandering beneath the brick buildings of Boise's Basque Block, dozing in the ruts along the Oregon Trail, prospecting for gold in the gulches northeast of town. In autumn, you can almost feel the breeze moving them about, dislodging them from the corners of the gardens, stirring them from beneath the leaves. Here, an enterprising engineer devised the valley's grand irrigation canal; there, a Shoshone boy traded camass roots. And before humans, there were short-faced bears larger than grizzlies, giant camels and horses like zebras. Ten-ton imperial mammoths used to wander our hills.

I DROP OFF MY SONS at school and help them hang up their coats. Then I walk through the park. To my right, across the river, rise the brick-and-glass buildings of Boise State University. To my left lie the art museum, the rose garden and the Boise Zoo. Beyond the zoo, patches of blue sky wink above the tops of downtown buildings. Snow sifts across the sidewalks. Seven crows land in a leafless hawthorn. Five take off again.

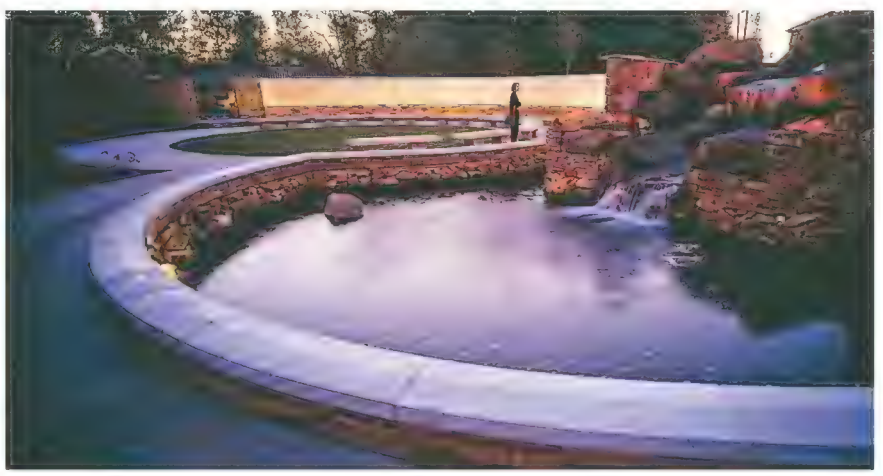
In this very spot last August it was 105 degrees. My sons and I stepped out of our air-conditioned car and the desert heat dropped on us like a predator—a sneak-up-from-behind mugger. Our eyes teared up and our breath disappeared and the kids covered their eyes with their forearms as if they'd been stung. Now maybe 100 mallards are gathered on the ice beneath the footbridge, squirming and ruffling and chirping at one another.

I live here because I can ride my bike to friends' houses just like I did when I was 10 years old, because I can float on a mostly clean river through the center of town and look up and see people working on their computers in office buildings. I live here because I can eat a $5 lunch at Zeppole, as I did for about 400 afternoons straight while I was writing my first novel, and because every time I think I'm running quickly along the trails in the foothills, someone is always there to blow past me and make me feel like I'm not in such good shape after all. I live here because I can get in a car and head in any direction and within an hour find myself in something pretty close to wilderness, and because of the archipelagoes of clouds that float over the hills in late summer, each one a towering, big-shouldered miracle.

Boise is still so young and new—changing almost every day—and I don't think it's overstatement to suggest that our town represents everything that remains great about America: potential, youth, natural beauty, quality of life. Some 100 parks, 14 museums, playgrounds everywhere you turn: our skies are huge; our houses affordable. Hikers can still drink from a secret spring in the hills; paddlers can still go kayaking in the morning and meet with their accountants by noon. When we visit friends who live elsewhere, they ask, "Boise? Really? Why do you live there?" But when friends visit us, they say, "Oh, wow, now I see."

What all of us who live here share is the landscape, the light, the seasons, the pair of peregrine falcons that nest downtown, and the rainbow trout that swim in our river. We share the feeling we get when the unexpected skitters across the road and cracks open the insulation we've packed around our mornings—when we remember for a moment where we live.

This morning in Julia Davis Park the sky is breaking apart everywhere. The foothills shine and billow. I look through the leafless branches of the trees and see the deer, once more, dancing across the road. I see the mystery and vastness of time. I think: this is the pure world. This is the long view. This is what lasts.



With its diverse activities (above left: a foothills bike trail; above right: the Idaho Anne Frank Human Rights Memorial), Boise is the kind of place, says Doerr, where "paddlers can still go kayaking in the morning and meet with their accountants by noon."

ANTHONY DOERR *is the author of* The Shell Collector *and* About Grace.

Read more contributions to My Kind of Town at Smithsonian.com/mykindoftown

WOW, THERE'S A MOUNTAIN.

It's funny for us to hear the things that new visitors find surprising, but the 10,600 ft. Sandia Mountains seem a little obvious to be a surprise to anyone.

Having a two-mile high mountain chain crowning our city provides us with more than romantic views from anywhere. It also affects our weather, giving us milder days and cooler evenings than nearby communities. Not to mention a perfect environment for shopping, outdoor dining, gallery strolls, and cycling or hiking the many and varied trails. But maybe the best thing our mountains give us is an amazing light show. For a little while every evening the setting sun is an artist, painting the mountains its own remarkable palette of golds and pinks and even crimson.

Many cities have unique structures that make their skylines distinct. In contrast to man-made icons, our distinction, our skyline, is real and natural just like the people who live here. What we've preserved in lieu of icons is a unique, rich blend of Native American, Hispanic and Western cultures shaped naturally over thousands of years.

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THIS MONTH IN HISTORY

APRIL ANNIVERSARIES
MOMENTOUS OR MERELY MEMORABLE

BY ALISON McLEAN

120 YEARS AGO
TRAVELS WITH CHARLIE

Charlie Chaplin is born April 16, 1889, in London. The son of actors, he hits the boards himself at age 5, and debuts on film at 25. Over a 53-year career, he will write, direct or star in more than 80 films, but it is his turns as the hapless Tramp—he's "forever seeking romance, but his feet won't let him," Chaplin says in 1933 (below: *The Rink*, 1916)—that bring him worldwide celebrity.

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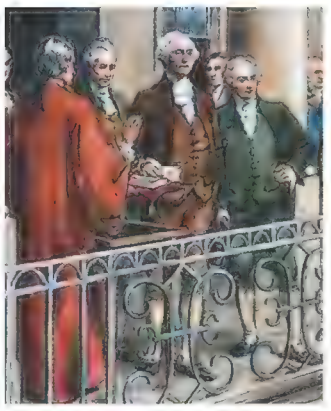


220 YEARS AGO
IT'S UNANIMOUS, BY GEORGE

George Washington, 57, elected the first president of the United States by a unanimous vote of the electoral college, takes the oath of office at Federal Hall in New York City, April 30, 1789. In his inaugural address—which he reads, appearing "agitated and embarrassed" by one account—he tells Congress to look to the Constitution for their priorities and to consider the public good when altering it, as the "sacred fire of liberty" depends on American democracy. After two terms, he refuses a third and leaves office in 1797.

60 YEARS AGO ALL FOR ONE

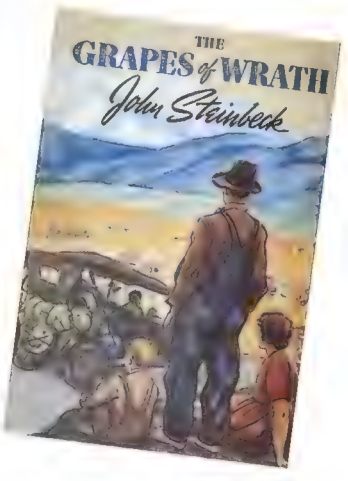
The United States and 11 Western European countries sign the North Atlantic Treaty in Washington, D.C., April 4, 1949, and create the North Atlantic Treaty Organization (NATO). Member nations pledge to consider a military attack on any NATO country an attack on all, and to provide assistance, including armed forces. Originally conceived as a defense against a Soviet invasion, NATO shifts its focus to maintaining stability in Europe after the 1991 breakup of the Warsaw Pact. Not until the September 11, 2001, attacks on the U.S. are NATO members—today numbering 26—called on to defend one of their own.

220 YEARS AGO CHRISTIAN CHARITY

"We were at length cast adrift in the open ocean," reports Lt. William Bligh of the mutiny he and 18 crew faced aboard the HMS *Bounty*, April 28, 1789. Sixteen months after the ship leaves England on a venture to transplant breadfruit plants from Tahiti to the West Indies, master's mate Fletcher Christian takes over the *Bounty*, consigning Bligh and his supporters to a 23-foot launch. Sailing chartless for 47 days, Bligh reaches safety in the Dutch East Indies. While some of the mutineers are eventually caught and hanged, Christian founds a colony on remote Pitcairn Island with some others, only to be killed in a revolt himself c. 1790.

70 YEARS AGO VINTAGE STEINBECK

John Steinbeck, 37, publishes *The Grapes of Wrath*, his novel of the Joads, a dispossessed Oklahoma dustbowl family forced into migrant labor, on April 14, 1939. The author, whose series of articles in the *San Francisco News* about migrant workers inspired the novel, is both hailed as a "sheer storytelling genius" and condemned as a socialist propagandist. The book sells half a million copies that year, and wins a Pulitzer Prize in 1940. Steinbeck wins the Nobel Prize for literature in 1962.



Understand the risks. Feel the benefits.™

What should I know about treating arthritis pain?

For many with arthritis pain, not treating is not an option. All prescription NSAID pain relievers, like Celebrex, ibuprofen and naproxen, help treat arthritis pain and have some of the same warnings. But since individual results may vary, having options is important.

Why should I consider Celebrex?

Prescription Celebrex has been the option for millions of patients for 10 straight years. Just one 200-mg Celebrex can provide dependable, 24-hour relief for many with arthritis pain, stiffness and inflammation. Based on the available data, the FDA stated that for certain patients Celebrex's benefits outweigh the risks. But only you and your doctor can make that decision.

What if I have a sensitive stomach?

If you are worried about stomach upset, you should know, in clinical studies, a lower percentage of patients taking Celebrex reported stomach discomfort, which includes indigestion, abdominal pain, and nausea, versus prescription ibuprofen and naproxen. However, all prescription NSAIDs, including Celebrex, increase the chance of stomach and intestine problems, such as bleeding and ulcers which can occur without warning and may cause death. With any of these medicines, patients also taking aspirin and the elderly are at increased risk for stomach bleeding and ulcers.

And if I'm taking low-dose aspirin?

If you are taking low-dose aspirin for your heart and need an NSAID pain reliever, Celebrex can be used because it doesn't interfere with the effects of low-dose aspirin. Ask your doctor if your NSAID pain reliever can be taken with low-dose aspirin.

But aren't there cardiovascular risks associated with NSAID use?

The FDA requires all prescription NSAIDs, including Celebrex, ibuprofen, naproxen and meloxicam, to have the same cardiovascular warning. They all may increase the chance of heart attack or stroke, which can lead to death. This chance increases if you have heart disease or risk factors for it such as high blood pressure or when NSAIDs are taken for long periods. Additionally, taking low-dose aspirin may not reduce the cardiovascular risk associated with NSAID use.

Any other precautions?

All prescription NSAIDs, including Celebrex, should be used at the lowest dose possible, for the shortest time, based on your individual treatment goals. Do not take Celebrex if you're pregnant or if you're allergic to aspirin or sulfonamides. All prescription NSAIDs, including Celebrex, increase the chance of serious skin reactions. And tell your doctor if you've had kidney or liver problems.

What should I do next?

Visit celebrex.com or call 1-888-celebrex. Ask your doctor if you could benefit from Celebrex. But most importantly, your doctor can tell you about the risks and benefits of all prescription NSAID pain relievers, including Celebrex.

Please turn page to see important information about Celebrex and other prescription NSAIDs.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Talk to your doctor to...Understand the risks. Feel the bene

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Medication Guide
for Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)
(See the end of this Medication Guide for a list of prescription NSAID medicines.)

What is the most important information I should know about medicines called Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines may increase the chance of a heart attack or stroke that can lead to death.
This chance increases:
- with longer use of NSAID medicines
- in people who have heart disease

NSAID medicines should never be used right before or after a heart surgery called a "coronary artery bypass graft (CABG)."
NSAID medicines can cause ulcers and bleeding in the stomach and intestines at any time during treatment. Ulcers and bleeding:
- can happen without warning symptoms
- may cause death

The chance of a person getting an ulcer or bleeding increases with:
- taking medicines called "corticosteroids" and "anticoagulants"
- longer use
- smoking
- drinking alcohol
- older age
- having poor health

NSAID medicines should only be used:
- exactly as prescribed
- at the lowest dose possible for your treatment
- for the shortest time needed

What are Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?
NSAID medicines are used to treat pain and redness, swelling, and heat (inflammation) from medical conditions such as:
- different types of arthritis
- menstrual cramps and other types of short-term pain

Who should not take a Non-Steroidal Anti-Inflammatory Drug (NSAID)?
Do not take an NSAID medicine:
- if you had an asthma attack, hives, or other allergic reaction with aspirin or any other NSAID medicine
- for pain right before or after heart bypass surgery

Tell your healthcare provider:
- about all of your medical conditions.
- about all of the medicines you take. NSAIDs and some other medicines can interact with each other and cause serious side effects. **Keep a list of your medicines to show to your healthcare provider and pharmacist.**
- if you are pregnant. **NSAID medicines should not be used by pregnant women late in their pregnancy.**
- if you are breastfeeding. **Talk to your doctor.**

What are the possible side effects of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

Serious side effects include:	**Other side effects include:**
• heart attack • stroke • high blood pressure • heart failure from body swelling (fluid retention) • kidney problems including kidney failure • bleeding and ulcers in the stomach and intestine • low red blood cells (anemia) • life-threatening skin reactions • life-threatening allergic reactions • liver problems including liver failure • asthma attacks in people who have asthma	• stomach pain • constipation • diarrhea • gas • heartburn • nausea • vomiting • dizziness

Get emergency help right away if you have any of the following symptoms:
- shortness of breath or trouble breathing
- chest pain
- weakness in one part or side of your body
- slurred speech
- swelling of the face or throat

Stop your NSAID medicine and call your healthcare provider right away if you have any of the following symptoms:
- nausea
- more tired or weaker than usual
- itching
- your skin or eyes look yellow
- stomach pain
- flu-like symptoms
- vomit blood
- there is blood in your bowel movement or it is black and sticky like tar
- skin rash or blisters with fever
- unusual weight gain
- swelling of the arms and legs, hands and feet

These are not all the side effects with NSAID medicines. Talk to your healthcare provider or pharmacist for more information about NSAID medicines.

Other information about Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)
- Aspirin is an NSAID medicine but it does not increase the chance of a heart attack. Aspirin can cause bleeding in the brain, stomach, and intestines. Aspirin can also cause ulcers in the stomach and intestines.
- Some of these NSAID medicines are sold in lower doses without a prescription (over-the-counter). Talk to your healthcare provider before using over-the-counter NSAIDs for more than 10 days.

NSAID medicines that need a prescription

Generic Name	Tradename
Celecoxib	Celebrex
Diclofenac	Cataflam, Voltaren, Arthrotec (combined with misoprostol)
Diflunisal	Dolobid
Etodolac	Lodine, Lodine XL
Fenoprofen	Nalfon, Nalfon 200
Flurbiprofen	Ansaid
Ibuprofen	Motrin, Tab-Profen, Vicoprofen* (combined with hydrocodone), Combunox (combined with oxycodone)
Indomethacin	Indocin, Indocin SR, Indo-Lemmon, Indomethagan
Ketoprofen	Oruvail
Ketorolac	Toradol
Mefenamic Acid	Ponstel
Meloxicam	Mobic
Nabumetone	Relafen
Naproxen	Naprosyn, Anaprox, Anaprox DS, EC-Naproxyn, Naprelan, Naprapac (copackaged with lansoprazole)
Oxaprozin	Daypro
Piroxicam	Feldene
Sulindac	Clinoril
Tolmetin	Tolectin, Tolectin DS, Tolectin 600

*Vicoprofen contains the same dose of ibuprofen as over-the-counter (OTC) NSAIDs, and is usually used for less than 10 days to treat pain. The OTC NSAID label warns that long term continuous use may increase the risk of heart attack or stroke.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

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Issued December 2008

Around the Mall

SCENES AND SIGHTINGS FROM THE SMITHSONIAN MUSEUMS AND BEYOND

BANKING ON GREEN

IN A MARYLAND FOREST, SMITHSONIAN SCIENTISTS AND CORPORATE EMPLOYEES ARE REDEFINING ON-THE-JOB TRAINING

PAGE 30

ANDREW CURTIS

Bank senior manager Read Currelly (far right; with a laser range finder) and colleagues teamed up with Jeff Lombardo (second from left), a researcher with the Smithsonian Environmental Research Center, to catalog trees as part of a study on climate change.

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Jukebox p. 30
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Q&A: Isaac Mizrahi p. 32
Making History p. 32
What's Up p. 34

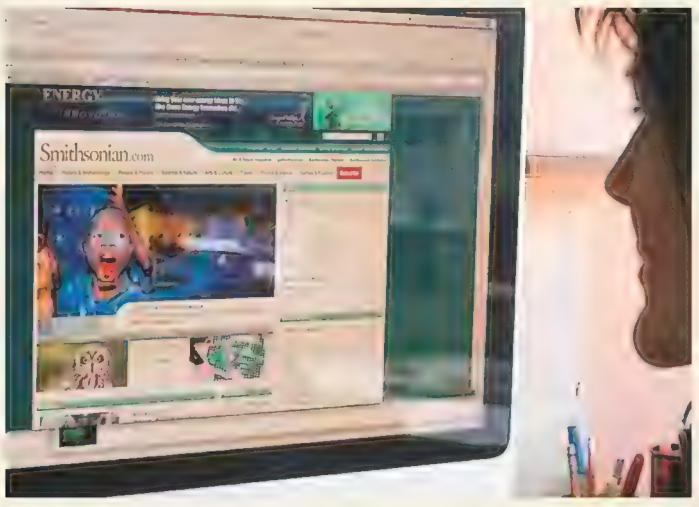
FROM THE CASTLE

Long Tails

G. WAYNE CLOUGH

NOT LONG AGO, publishing and other media businesses mostly aimed to sell blockbusters. At a January conference on the Smithsonian's digital future, Chris Anderson, editor in chief of *Wired* magazine, explained that until recently the scarcity of shelf space, movie screens and TV channels winnowed out all but best sellers. But now the Web has dramatically increased consumer choice. Sites such as Amazon.com, Netflix and iTunes still offer best sellers, but they also offer millions of esoteric titles. In his book, *The Long Tail*, Anderson argues that the "future of business is selling less of more." Today, he says, public interest is shifting to a huge number—the long tail—of individual niche interests.

With 137 million objects and specimens in our collections and a staff of thousands of specialized curators, scientists and numerous other professionals, the Smithsonian Institution (SI) potentially has one of the world's longest tails. While many visitors to our Web sites will view our best-loved artifacts—the Wright Flyer, the Ruby Slippers, the Hope Diamond—many others will seek out less popular items. For every object in our collections, there will be at least a few passionate advocates. In the future, increasingly—through blogging, twittering, photo- and video-sharing, Wiki communications and myriad other ways—Web visitors all over the world will share their knowledge and curiosity with us and with one another.



The Smithsonian online: something for everyone, no matter how esoteric their interests.

The Smithsonian has already digitized hundreds of thousands of objects and created hundreds of innovative Web experiences; last year we hosted more than 172 million virtual visitors. At the recent digital future conference, 35 Web and new media leaders helped us "Reimagine the Smithsonian in the Digital Age." In addition to Anderson, we heard creativity expert Bran Ferren; *Here Comes Everybody* author Clay Shirky; and George Oates, former chief designer of the photo-sharing Web site Flickr. The group viewed some of our collections and spoke with the creators of SI Web-based initiatives. We discussed such challenges as encouraging user-generated content while maintaining the Institution's quality standards.

New SI Web initiatives emerge daily. In February, the National Museum of the American Indian announced progress toward putting its entire 800,000-item collection online—with each item inviting Web visitors to add to our knowledge about it (www.AmericanIndian.si.edu/searchcollections). As we travel the many roads inspired by our collections, the Smithsonian will embrace the Internet's new interactive engagement. Do log on to www.si.edu. And enjoy the ride.

G. WAYNE CLOUGH *is Secretary of the Smithsonian Institution.*

Smithsonian Institution

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G. Wayne Clough

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FOREST HIRES

BANKERS TRADE IN THEIR SUITS AND TIES TO STUDY THE ENVIRONMENT

BRIAN SHEPPARD examines several hickory nuts on the forest floor at the Smithsonian Environmental Research Center (SERC)—a 2,800-acre campus of forests, marshes and farmland on the Chesapeake Bay. He looks at the branches above, searching for the tree from which they fell.

With the help of Jeff Lombardo, a SERC forest ecology researcher, Sheppard is recording the location, species and size of all the trees in a designated wooded plot—part of an ongoing study of forests and climate change. It's a far cry from a regular day at the office for Sheppard, who is vice president for eBusiness at HSBC-North America in Buffalo, New York. "I couldn't identify a tree to save my life before I came here," he says.

Along with 11 other bank employees at SERC, Sheppard is a volunteer with HSBC's $100 million Climate Partnership program. Assisted by the Earthwatch Institute, an international nonprofit organization, HSBC employees are being dispatched to five climate research centers worldwide in the United States, Brazil, China, India and England.

SERC hosts the North American center, where Earthwatch estimates that 53 HSBC teams will put in 22,000 hours of work over the course of the five-year program. These teams are collecting data for a long-term study on how climate change alters the composition of a forest and how logging affects a forest's ability to store carbon. Without the bank's "citizen-scientists," Lombardo says, "we could never do this kind of project on this scale." He hopes to expand the research to include the Contee Farm, a newly acquired 575-acre SERC property in Edgewater, Maryland, that contains a rare swath of old-growth forest.

HSBC says that giving employees this hands-on experience will eventually lead to a greening of the bank. Before leaving SERC, all participants must come up with an action plan to cut down on energy or water consumption, reduce carbon emissions or lower waste production in their office.

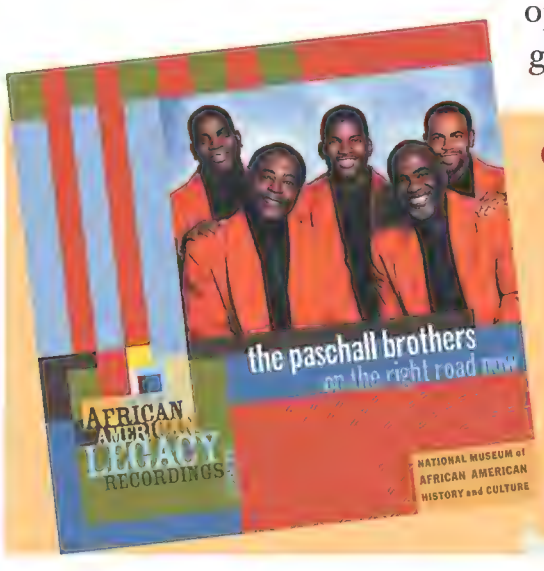
"Becoming a climate champion for HSBC has really opened my eyes and gotten me totally excited in spreading the word to all that will listen," Sheppard wrote in an e-mail. He says his eBusiness department is encouraging the use of online statements and tax forms to save paper.

Bank manager Kellie Johnson says that recording the location, species and size of trees "puts things in perspective."

According to Dan Stover, Earthwatch's field director at SERC, such small changes can have a huge impact when amplified to the scale of a large investment bank. HSBC estimates that reducing paper usage by just 10 percent in their U.S. offices would save about 10,000 trees annually and reduce greenhouse gas emissions linked to global warming by 1,700 tons.

"As a scientist, I spent a lot of time publishing articles in journals, hoping to make a change that really has an impact on the environment," says Stover. "But these guys are really doing it."

Linda Bartos, who works in HSBC's information technology department, took the lead on publicizing a company-wide program that shuts down up to 12,000 of the organization's computers at night, saving nearly one million kilowatt hours a month. "Our jobs are pretty intense," Bartos says as she tags another tree, "and at times you can lose track of things like this." **KENNETH R. FLETCHER**


the paschall brothers
on the right road now
AFRICAN AMERICAN LEGACY RECORDINGS
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ODES TO JOY As a young man in the 1940s and '50s, the late Rev. Frank Paschall Sr. toured Tidewater, Virginia, singing in a cappella groups. He passed his musical wisdom on to his sons, who became the Paschall Brothers—one of few remaining African-American gospel quartets. Their songs, which include "Joy" and "Jesus Gave me Water," are also influenced by soul artists such as the Temptations and Sam Cooke.

The Paschall Brothers' album, "On the Right Road Now," was one of two Smithsonian Folkways recordings recently named winners at the eighth annual Independent Music Awards. Hear the hymns at Smithsonian.com/jukebox. **JOSEPH CAPUTO**

JUKEBOX

ANDREW CUTRARO; SMITHSONIAN FOLKWAYS RECORDINGS

THE OBJECT AT HAND

1967 Buffet Crampon

NATIONAL MUSEUM OF AMERICAN HISTORY

A GOOD REED

Late in his career, Benny Goodman favored a Parisian "licorice stick"

BY OWEN EDWARDS

Goodman (right: in 1982) played the clarinet even "during the commercial breaks of the World Series," according to one of his daughters.

IN THE HIERARCHY of musical instruments, the clarinet tends to get short shrift—at least compared with the violin, cello or piano. But the inauguration of Barack Obama raised the instrument's profile when Anthony McGill, principal clarinetist of the Metropolitan Opera orchestra, performed with cellist Yo-Yo Ma, violinist Itzhak Perlman and pianist Gabriela Montero before a global television audience estimated at a billion viewers. (The fact that cold weather forced the musicians to finger-sync to their own recording hardly diminished the clarinet's star turn.)

The clarinet's other notable high notes include 1771, when Mozart composed the first of two clarinet works, a divertimento, and 1920, when 11-year-old Beno Goodman first picked up the instrument in a Chicago tenement. Beno, the ninth of 12 children born to Russian-immigrant parents, would of course become Benny Goodman, and would perform some of the greatest music of the big-band or any other era.

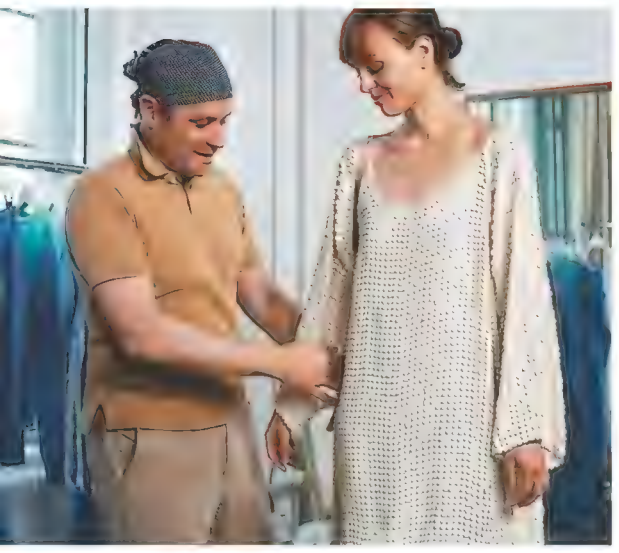
One of Goodman's clarinets now resides within the collections of the Smithsonian National Museum of American History (NMAH), where Jazz Appreciation Month is celebrated each April and where Goodman's centenary year—he was born May 30, 1909—will be enthusiastically observed next month. In the hands of a man who was equally at home in jazz and classical music, the clarinet was—to use its affectionate nickname—one sweet licorice stick.

"Benny Goodman was the most popular clarinetist in American history," says curator John Edward Hasse. "As a clarinetist and a band leader, he played a key role in moving jazz from the margins of American society to the mainstream. He led the most influential, for a time the most popular, and perhaps the most polished of the big bands of the swing era."

Goodman's NMAH clarinet was crafted in the workshops of the legendary Parisian woodwinds manufacturer Buffet Crampon in 1967. The maestro used it during the latter part of a long career. "He was playing in smaller jazz groups by then," says Russ Connor, author of *Benny Goodman: Listen to His Legacy*. In the years after the big-band

A curator's collection of Goodman performances is at Smithsonian.com/goodman

HUGH TALMAN / NMAH, SI; DERICK A. THOMAS / DAT'S JAZZ / CORBIS



Q&A

Fashion designer **ISAAC MIZRAHI** used Alaskan salmon skin (right) to create a dress for the upcoming exhibition "Design for a Living World," opening May 14 at New York City's Cooper-Hewitt, National Design Museum. Mizrahi spoke with Smithsonian's Joseph Caputo.

WHAT LED YOU TO DESIGN A SALMON-SKIN DRESS? I saw the salmon skin and thought I could do something incredibly glamorous with it because it resembles leather. I think the outcome was fabulous, because the salmon skin, the way it was finished, is somewhat shiny and sparkly.

ARE WE GOING TO SEE FISH-SKIN DRESSES IN STORES ANYTIME SOON? It's not outside the realm of possibility.

AS A FASHION DESIGNER, YOU'RE ACCUSTOMED TO SETTING TRENDS. DO YOU THINK NATURAL MATERIALS ARE GOING TO CATCH ON? I see it eventually becoming more pervasive. It makes consumers feel better about themselves.

DOES YOUR WORK HAVE AN ENVIRONMENTAL AGENDA? Frankly, unless something is really glamorous and amusing, I'm not going to sell my artistic principles short for the sake of "going green." I admire those who do, but I don't start by thinking "Oh, let's make some green clothes." But, if something is green and incredibly stylish, then yes.

But the more I think about environmental issues, the more it's going to affect what I do every day. For people in their teens and 20s, it's an important part of their agenda. I'm from a different age, in my late 40s, so hopefully they will take me along.

MAKING HISTORY

A juvenile tapetail in the process of becoming an adult grows a huge liver.

A FISH TALE Appearances can be deceiving. For decades, scientists thought that whalefishes, bignose fishes and tapetails came from three different families of fish. But G. David Johnson, a curator at the National Museum of Natural History, recently proved that all three are the same kind of fish at different life stages—a finding comparable to learning that a baby gerbil will grow up to become either a squirrel or a chipmunk. (It won't.)

The transformation of a juvenile tapetail into an adult bignose fish or whalefish demonstrates one of the most extreme examples of metamorphosis in vertebrates. To become a bignose, a tapetail's upper jawbones fuse to its nasal bone, it loses its stomach and esophagus and lives off its liver.

Johnson's research relied on the capture of a female in the midst of metamorphosis, comparative anatomical studies and DNA analyses. The discovery also explains why past researchers had found only female whalefishes and male bignose fishes. The "missing" males and females were not missing at all. They were two very different-looking sexes of the same fish. The answer was right there all along—or, as Johnson puts it, "Well, duh!" **JOSEPH CAPUTO**

Watch these fish transform at Smithsonian.com/tapetail

heyday, Connor adds, Goodman "had more time to play classical music. He was very choosy about instruments and reeds; even though he'd played Selmer clarinets and advertised for them earlier in his career, he had a natural affinity for the Buffet."

In 1990, four years after Goodman's death at age 76, his daughters Rachel Goodman Edelson and Benjie Alice Goodman Lasseau donated the instrument, along with a music stand and chair used by their father during practice sessions, to the Smithsonian. "He practiced all the time," recalls Lasseau, "and he always seemed to have a clarinet handy. He even practiced during the commercial breaks of the World Series."

Goodman performed until the end of his life. "He died of a heart attack in his New York City apartment in June 1986 while rehearsing for a Mostly Mozart concert," says Susan Satz, business manager for the Goodman estate.

Goodman's crossover genius—he brought classical training to jazz, even as he raised the stature of jazz and expanded its audience—was on brilliant display in the now-legendary Carnegie Hall concert of January 16, 1938. On that memorable night, Goodman brought his big band, including such greats as drummer Gene Krupa, trumpeter Harry James and vibraphonist Lionel Hampton, to the great Manhattan bastion of the classics. When Goodman and crew lit up the hall with hot-jazz composer Louis Prima's number "Sing, Sing, Sing," people began dancing in the aisles, a first for the venerable symphony space.

"I grew up listening to all of [Goodman's] recordings," McGill told me in a phone interview after the Obama inaugural. "His recordings of works by Aaron Copland, Morton Gould, Igor Stravinsky and others are still available, so he's still enormously influential. Goodman was such a superstar that you really have to listen."

OWEN EDWARDS *is a freelance writer and author of the book* Elegant Solutions.

MACKENZIE STROH / COOPER-HEWITT MUSEUM, SI; G. DAVID JOHNSON / NMNH, SI

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What's Up

ART WITH A SOFT TOUCH

Danish designer Louise Campbell's *Bless You* chair (right: 1999) joins more than 70 bold fabrications at New York City's Cooper-Hewitt, National Design Museum's "Fashioning Felt," on view until September 7.

STOLEN TREASURES

On March 18, 1990, two men in police uniforms broke into Boston's Isabella Stewart Gardner Museum and got away with $500 million in art. Ulrich Boser recounts the riveting tale of the unsolved caper in *The Gardner Heist* (Smithsonian Books, 2009).

A HEARTBEAT AWAY

Vice presidents are often seen as marginal figures, but 14 have gone on to become president, including Richard M. Nixon (below). See more "Presidents in Waiting" at the Portrait Gallery through January 3.

CRAFTINESS ON DISPLAY

Ceramist Emily Rossheim uses luminescent underglazes to make her bowls shimmer (below). She is just one of 120 jury-selected artists whose work will be available for sale at the 27th Annual Smithsonian Craft Show April 23 through 26.

CREEPING BEAUTY

French artist Louise Bourgeois (born 1911) is best known for her elegant, metallic sculptures of spiders (below: 2003). Several are nesting at the Hirshhorn through May 17.

BY JOSEPH CAPUTO

ERIK BRAHL / COOPER-HEWITT MUSEUM, SI; SI BOOKS; JAMES COX GALLERY AT WOODSTOCK FOR THE JAMES CHAPIN ESTATE / NPG, SI; ROSSHEIM / MARRINSON STUDIOS; CHRISTOPHER BURKE / HIRSHHORN MUSEUM, SI

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Isfahan's artisans are striving to restore ancient Persia's capital city to its former luster

BY ANDREW LAWLER

PHOTOGRAPHS BY GHAITH ABDUL-AHAD

Smithsonian
APRIL 2009 · VOLUME 40, NUMBER 1

THE COURTYARD IS COATED in a fine brown dust, the surrounding walls are crumbling and the flaking plaster is the same monotonous khaki color as the ground. This decrepit house in a decaying maze of narrow alleys in Isfahan, Iran, betrays little of the old capital's glory days in the 17th century. Suddenly, a paint-splattered worker picking at a nearby wall shouts, waves his steel trowel and points. Underneath a coarse layer of straw and mud, a faded but distinct array of blue, green and yellow abstract patterns emerges—a hint of the dazzling shapes and colors that once made this courtyard dance in the shimmering sun.

I crowd up to the wall with Hamid Mazaheri and Mehrdad Moslemzadeh, the two Iranian artist-entrepreneurs who are restoring this private residence to its former splendor. When these mosaics were still vibrant, Isfahan was larger than London, more cosmopolitan than Paris, and grander, by some accounts, than even storied Istanbul. Elegant bridges crossed its modest river, lavishly outfitted polo players dashed across the world's largest square and hundreds of domes and minarets punctuated the skyline. Europeans, Turks, Indians and Chinese flocked to the glittering Persian court, the center of a vast empire stretching from the Euphrates River in what is today Iraq to the Oxus River in Afghanistan. In the 17th century, the city's wealth and

Four hundred years ago, Isfahan was larger than London and more cosmopolitan than Paris. The city's most famous bridge (above), Si-o Seh Pol (Bridge of 33 Arches) is nearly 1,000 feet long and 45 feet wide.

grandeur inspired the rhyming proverb, *Isfahan nesf-e jahan,* or "Isfahan is half the world."

After a brutal siege shattered that golden age in the early 18th century, new rulers eventually moved the capital to Tehran, leaving Isfahan to languish as a provincial backwater, which not incidentally left many of the old city's monuments intact. "One could explore for months without coming to an end of them," marveled British traveler Robert Byron on his 1933-34 journey across Asia. That artistry, he wrote in *The Road to Oxiana,* "ranks Isfahan among those rarer places, like Athens or Rome, which are the common refreshment of humanity."

Today, however, the city is mainly known abroad as the site of Iran's premier nuclear research facility. What once was a sleepy town has emerged as the country's third largest metropolis, surrounded by expanding suburbs, belching factories and the choking traffic of more than three million people. Nothing symbolizes Iran's disconcerting modernity more than its launch, in February, of a satellite named *Omid* (Hope). In Isfahan, however, hope is a commodity in sharp decline. The elegant urban landscape that survived invasions by Afghan tribesmen and Mongol raiders is now threatened by negligence and reckless urban development.

Isfahan's location along a trade route connecting the Caspian Sea with the Persian Gulf helped transform it into the Florence of Persia. Residents still crowd its lively teahouses today.

MAZAHERI AND MOSLEMZADEH are members of a new generation of Isfahanis who want to restore not just buildings but their city's reputation as a Persian Florence, one they hope will one day enthrall Westerners with its wonders once again. Inside the cool and dark interior of the house that is their current focus, the freshly painted white stucco ceiling bristles with scalloped stalactites. Delicate gilded roses frame wall paintings of idyllic gardens. (Paradise is a Persian word meaning "walled garden.") Above a central fireplace, hundreds of inset mirrors reflect light from the courtyard. "I love this profession," says Safouva Saljoughi, a young, chador-clad art student who is dabbing at a faded painting of flowers in one corner of the room. "I have a special relationship with these places."

The house may have been built in the 17th century by a wealthy merchant or prosperous government official, then remodeled to suit changing tastes over the next two centuries. Even the fireplace damper is shaped in the delicate figure of a peacock. "Ornament and function together," says Mazaheri in halting English. Located just a short walk from the medieval Friday Mosque, the house is of classic Iranian design—a central courtyard surrounded by rooms on two sides, a single entrance on the third and a grand two-story reception room with large windows on the fourth.

Rocket attacks during the war with Saddam Hussein's Iraq in the early 1980s emptied this old neighborhood, and the house was badly vandalized. As Moslemzadeh guides Saljoughi's careful restoration effort, Mazaheri nods toward gaping holes in the reception room, which once held oak-framed stained glass that bathed the interior in a rainbow of vivid colors. "There are still a few masters left in Isfahan who can rebuild such windows," he says. Just repairing the elaborate stucco ceiling took five professionals on scaffolding more than a year.

Trained as a specialist in conservation techniques, the lean and energetic Mazaheri, 38, says he has built a restoration business that tackles anything from old ruins to 17th-century wall paintings. Together with his colleague Moslemzadeh, who is 43 and studied art conservation in St. Petersburg, Russia, they are investing their time and profits to convert this wreck of a home into a teahouse where visitors can appreciate traditional Isfahani crafts, music and art. Like many Isfahanis I meet, they are welcoming to foreigners, refreshingly open and immensely proud of their heritage. Without a trace of irony or discouragement, Mazaheri looks around the half-finished reception room and says, "It may take five more years to finish fixing this place up."

ISFAHAN'S HISTORY is an epic cycle of fabulous boom and calamitous bust. Here a road traveling across the Iranian plateau east to the Mesopotamian plain meets a path connecting the Caspian Sea to the north with the Persian Gulf to the south. That geography linked the city's fate to the merchants, pilgrims and armies who passed through. Blessed with a pleasant climate—the city lies at nearly the same altitude as Denver and has relatively mild summers—Isfahan evolved into a bustling township at ancient Persia's crossroads.

A taxi driver, thumbing intently through his Persian-English dictionary as he swerves through dense traffic, offers to sell me a gold statue he claims is 5,000 years old. I would be surprised if it were authentic—not least because such ancient artifacts remain elusive, making it difficult to

MAP: GUILBERT GATES; ALL PHOTOS BY GHAITH ABDUL-AHAD / REPORTAGE BY GETTY IMAGES

UPPER LEFT: HIP / THE IMAGE WORKS; UPPER RIGHT: BRIDGEMAN ART LIBRARY; P. 43 LOWER RIGHT: MEHRDAD MOSLEMZADEH

pinpoint the precise era when Isfahan emerged as an urban center. What little has been found of the city's distant past I see in the basement of the cultural heritage office, an immaculately restored 19th-century villa just down the street from Mazaheri and Moslemzadeh's project. A few boxes of stone tools sit on a tile floor, and a couple of dozen pieces of pottery—one incised with a writhing snake—lie on a plastic table. A few miles outside town, on top of an imposing hill, sit the unexcavated ruins of a temple, which may have been built during the Sassanian Empire that dominated the region until the Arab conquest in the 7th century A.D. Within the city itself, Italian archaeologists digging below the Friday Mosque just before the 1979 Islamic Revolution found Sassanian-style columns, hinting that the site originally might have been a Zoroastrian fire temple.

The breathtakingly beautiful Imam Mosque (top left: in an 1867 sketch) was commissioned by Shah Abbas I (top right: in a 1627 sketch) as part of his bid to turn Isfahan into a global metropolis. The mosque, on the south side of Naqsh-e Jahan Square, still graces the city's skyline.

The city's first recorded golden age is traced to the arrival of the Seljuk Turks from Central Asia in the 11th century. They turned the town into their capital and built a magnificent square leading to an enlarged Friday Mosque festooned with two domes. Though the mosque's southern

dome—facing Mecca—is larger and grander, it is the northern dome that has awed pilgrims for a thousand years. Peering up toward the apex 65 feet above the pavement, I feel a pleasant and unexpected vertigo, the perfect balance of harmony in motion. "Each element, like the muscles of a trained athlete, performs its function with winged precision," wrote Robert Byron.

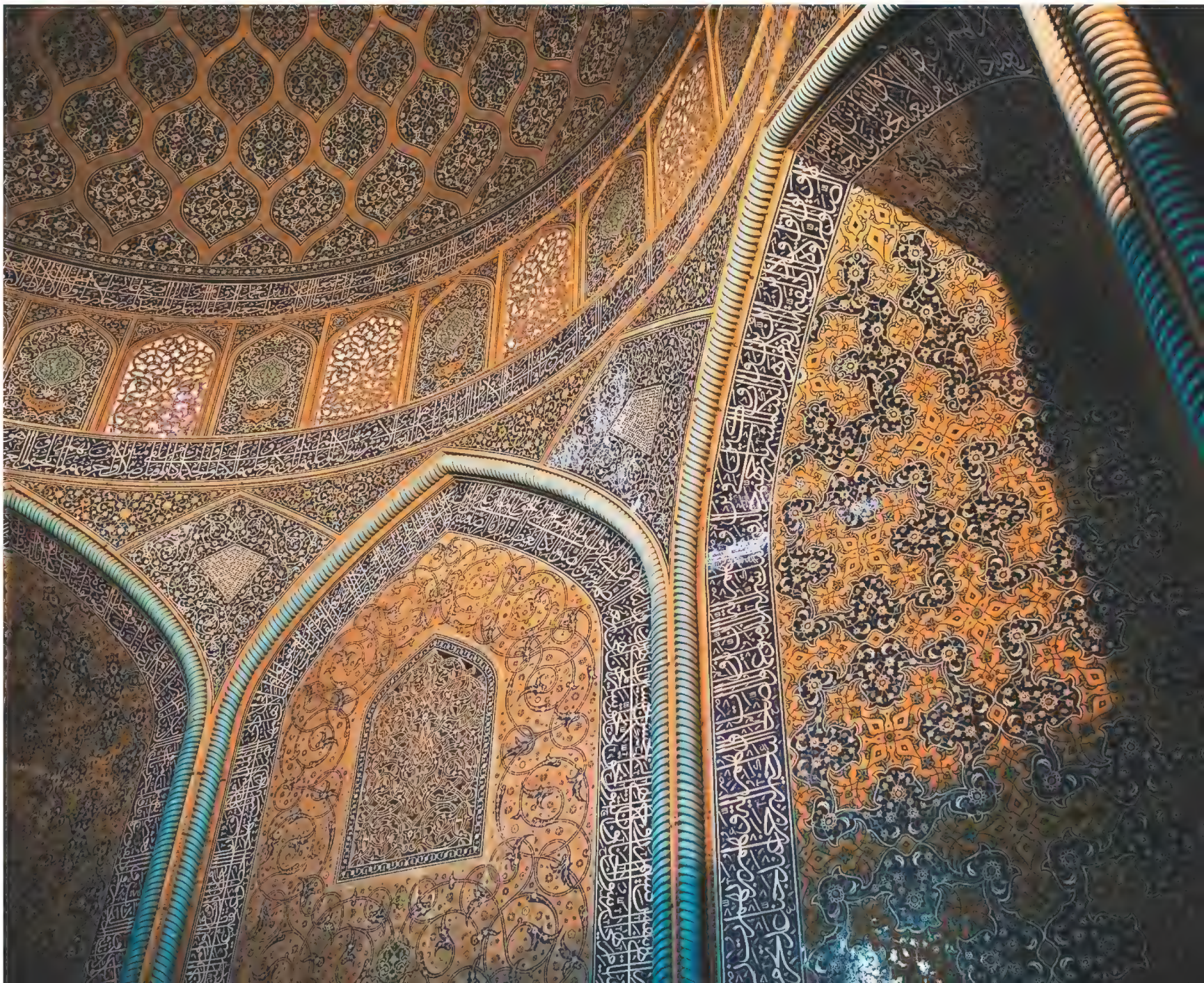
Unlike St. Peter's Basilica in Rome or St. Paul's Cathedral in London, there are no concealed chains holding either dome in place; the architects relied only on their mathematical and engineering abilities. A meticulous analysis of the north dome in the 1990s found it to be unusually precise, not just for the 11th century, but even by today's standards. Known as Gunbad i-Khaki (the dome of earth), this graceful structure may have been influenced or even designed by one of Persia's most famous poets, Omar Khayyám, who was invited to Isfahan in 1073 to take charge of the sultan's observatory. Though remembered primarily for his verse, Khayyám was also a brilliant scientist who wrote a seminal book on algebra, reformed the calendar and is said to have demonstrated that the sun was the center of the solar system 500 years before Copernicus.

Alpay Ozdural, a Turkish architect who taught at Eastern Mediterranean University until his death in 2005, believed that Khayyám played a key role in the dome's alignment and construction in 1088-89, creating what amounts to a mathematical song in brick. (Although many scholars are skeptical about this theory, Ozdural claimed that a tantalizing clue could be found in a verse of Khayyám's poetry: "My beauty's rare, my body fair to see, tall as a cypress, blooming like the tulip; And yet I don't know why the hand of Fate sent me to grace this pleasure-dome of Earth.") Just three years after the completion of the dome, the sultan died, the observatory closed, the reformed calendar was abolished and Khayyám—who had little patience with Islamic orthodoxy—later left Isfahan for good.

More than a century later, in 1228, Mongol troops arrived, sparing the architecture but putting many inhabitants to the sword. The city fell into decay and fighting erupted between rival Sunni sects. "Isfahan is one of the largest and fairest of cities," wrote Arab traveler Ibn Battuta when he passed through in 1330. "But most of it now is in ruins." Two generations later, in 1387, the Central Asian conqueror Tamerlane avenged a revolt in Isfahan by massacring 70,000 people. Buildings were again left untouched, but Tamerlane's men added their own macabre monument in the form of a tower of skulls.

It would be another two centuries before Isfahan would rise again, under the reign of Shah Abbas I, the greatest ruler

The city's grandeur inspired the proverb, "Isfahan is half the world." Clockwise, from top left: a battle scene adorns the Palace of Forty Columns; the interior dome of the Imam Mosque; inside the Sheikh Lotf-Allah Mosque; interior dome of the Friday Mosque.



of the Safavid Empire (1501-1722 A.D.). Cruel as Russia's Ivan the Terrible, canny as England's Elizabeth I and extravagant as Philip II of Spain (all contemporaries), Abbas made Isfahan his showplace. He transformed the provincial city into a global metropolis, importing Armenian merchants and artisans and welcoming Catholic monks and Protestant traders. He was generally tolerant of the Jewish and Zoroastrian communities that had lived there for centuries. Most remarkably, Abbas sought to establish Isfahan as the political capital of the first Shiite empire, bringing learned theologians from Lebanon to bolster the city's religious institutions—a move begun by his predecessors that would have profound consequences for world history. The arts thrived in the new capital; miniaturists, carpet weavers, jewelers and potters turned out ornate wares that enhanced the mansions and palaces that sprang up along spacious avenues.

Abbas was a man of extremes. A European visitor described him as a ruler whose mood could quickly turn from jolly to "that of a raging lion." Abbas's appetites were legendary: he boasted an enormous wine cellar and a harem that included hundreds of women and more than 200 boys. His true love, however, was power. He blinded his father, brother and two sons—and later killed a third son, whom he feared as a political threat, passing the throne to a grandson.

Abbas was nearly illiterate but no one's fool. He is said to have personally held up a candle for the celebrated artist Reza Abbasi while he sketched. Abbas could hunt, clean and cook his own fish and game. He loved to roam Isfahan's markets, eating freely from stalls, taking whatever shoes on display suited him and chatting with whomever he pleased. "To go about in this way is to be a king," he told scandalized Augustinian monks accompanying him on one of his jaunts. "Not like yours, who is always sitting indoors!"

During the last half of his extraordinary 42-year reign, which ended with his death in 1629, Abbas left behind an urban landscape that rivaled or exceeded anything created in a single reign in Europe or Asia. The French archaeologist and architect André Godard, who lived in Iran early in the 20th century, wrote that Abbas' Isfahan "is above all a plan, with lines and masses and sweeping perspectives—a magnificent concept born half a century before Versailles." By the mid-1600s, that plan had filled out into a city that boasted a population of 600,000, with 163 mosques, 48 religious schools, 1,801 shops and 263 public baths. The elegant main street was 50 yards wide, with a canal running down the middle, filling onyx basins strewn with the heads of roses and shaded by two rows of chinar trees. Gardens graced the pavilions, which lined either side of the promenade called the Chahar Bagh. "The Grandees were airing

For centuries, Isfahan has been home to merchants, architects and artisans. Clockwise from top left: an artist presses patterns on fabric; women shop in the bazaar; Mehrdad Moslemzadeh works to return a house to its former splendor; a craftsman hammers copper pots.

themselves, prancing about with their numerous trains, striving to outvie each other in pomp and generosity," remarked one visiting European.

That conspicuous consumption came to an abrupt halt nearly half a century later, when an Afghan army besieged the city for six long months in 1722. Women hawked their pearls and jewels until even precious stones couldn't buy bread. Cannibalism followed. An estimated 80,000 people died, most from hunger. The Afghans left most of the city intact. But that trauma—followed later by the transfer of the capital to Tehran far to the north—wrecked the city's status and prosperity.

"BUSH GOOD!" says a twentysomething Isfahani as he joins me on a park bench in the middle of Naqsh-e Jahan Square. It's Friday morning—the Muslim sabbath—and the vast rectangular space is quiet save for the sound of the fountains. Like many young people I meet here, my companion complains about rising inflation, government corruption and religious meddling in politics. He also fears a U.S. invasion. "We're happy Saddam is gone," he adds. "But we don't want to become like Iraq." A math student with little prospect for work, he dreams of seeking his fortune in Dubai, Australia or New Zealand.

Four centuries ago, this square, which is also called the Maidan, was the economic and political heart of a prosperous and largely peaceful empire that drew foreigners from around the world. "Let me lead you into the Maidan," wrote Thomas Herbert, secretary of the English ambassador to the Persian court from 1627 to 1629, which is "without doubt as spacious, as pleasant and aromatic a market as any in the universe." Measuring 656 by 328 feet, it was also one of the world's largest urban plazas.

But unlike vast concrete spaces such as Tiananmen Square in Beijing or Red Square in Moscow, Naqsh-e Jahan served alternatively and sometimes simultaneously as a marketplace, polo field, social meeting point, execution ground and festival park. Fine river sand covered the plaza, and vendors peddled Venetian glass in one corner and Indian cloth or Chinese silks in another, while locals sold firewood, iron tools or melons grown with pigeon droppings collected from special towers surrounding the city. Acrobats passed their hats, hawkers called out their wares in several tongues and hucksters worked the throngs.

A mast in the middle was used for archery practice—a horseman would ride past it at full gallop, then turn to shoot down an apple, silver plate or gold cup on top. Marble goal posts that still stand at either end of the square are reminders of the fierce polo matches at which the shah on a heavily bejeweled mount often joined others dressed in fantastic colors and bold plumage.

A Zoroastrian fire temple (top) sits on a hill near Isfahan. Among the city's newest additions is an ungainly shopping and office complex (bottom) that threatened Isfahan's status as a United Nations World Heritage site.

Today the sand, merchants, hucksters and polo players are all gone, tamed by early 20th-century gardens. Yet the view around the square remains remarkably unchanged. To the north is a great arch opening into the high vaulted ceilings of a snaking, covered marketplace that stretches nearly a mile. To the south is the Imam Mosque, a mountain of brick and colored tile. Facing each other on the east and west sides of the square are the Sheikh Lotf-Allah Mosque, with its pale brown-and-blue dome, and the Ali Qapu palace. That structure—dismissed by Byron as a "brick boot box"—is topped by slender columns that turn it into a regal grandstand; bright silk curtains once hung from above to block the sun. The two mosques bend at odd angles to orient toward Mecca, saving the square from a rigid orderliness, while two-story arcades for shops define and unify the whole.

In contrast, my initial impression of the Chahar Bagh promenade, which is west of the Maidan, is tinged with panic rather than tranquillity. Unable to find a cab, I've hopped on the back of a motorcycle ridden by a middle-aged Isfahani who motioned me to get on. As we zip between cars through stop-and-go traffic, I worry that my knees will be sheared off. Construction of a new subway tunnel under the historic street has blocked a lane of traffic. The subway, preservationists say, threatens to suck in water from the river, shake delicate foundations and damage the fountains gracing the old promenade.

Frustrated by gridlock, my driver suddenly veers off the road and onto a central walking path, dodging nonplused pedestrians who stroll the park. The onyx basins filled with roses are long gone, the men are in jeans and the women are dressed uniformly in drab black. But flashes of stiletto heels and hennaed hair—and the sleek dresses for sale in the neon-lit shops that long ago replaced the elegant pavilions—speak of Isfahanis' enduring sense of fashion.

Pulling back onto the road, we speed by a giant new shopping and office complex that sports a modern skyscraper. In 2005, officials at the United Nations Educational, Scientific and Cultural Organization (Unesco) warned that unless the building was downsized, the nearby Maidan could lose its status as a World Heritage site. City managers eventually lopped two stories off the offending tower, but its ungainly presence still galls many locals.

Heading north toward the Friday Mosque, we arrive at busy Atiq (Old) Square, crowded with small shops and sidewalk vendors. My motorcycle driver drops me off at the curb, and, with typical Iranian hospitality, zooms off before I can either thank or tip him.

The square is part of the Seljuk plaza built in the 11th century, but over time houses and stores have encroached on its original borders. Now city officials plan to raze what they call "unauthorized structures," restore the

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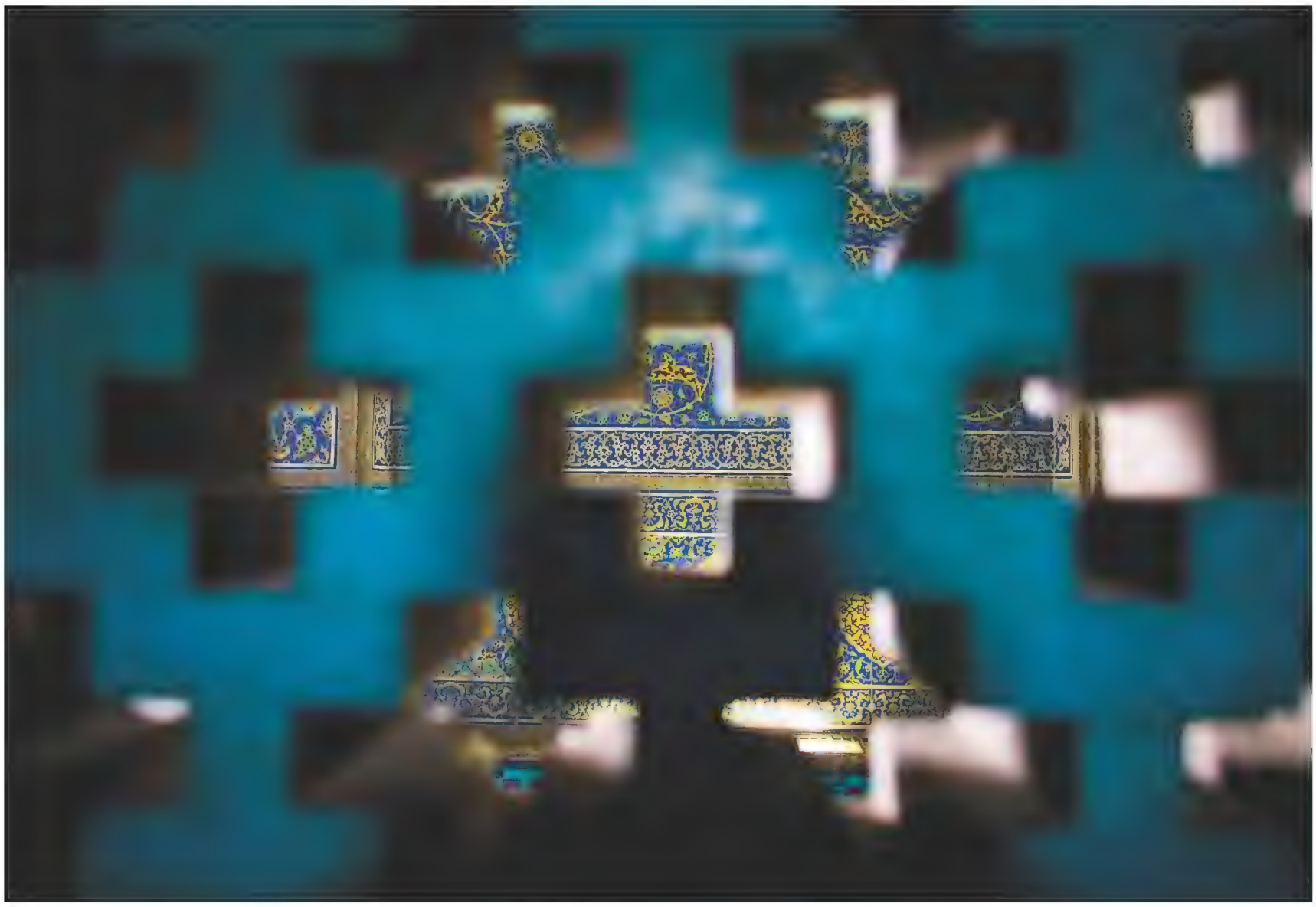
original trapezoidal plan and clear the area around the mosque. That proposal has split Isfahan's cultural heritage community. The plaza is "dirty now," says one city official. He wants to tear down the houses and stores and put up designer shops.

Such talk disturbs Abdollah Jabal-Ameli, a retired chairman of the city's Cultural Heritage Organization and a respected architect who helped restore the Maidan. "You have to take an organic view," he tells me. Since there is little left of the original square, Jabal-Ameli says, wiping out the houses and stores that have grown up around it in the past millennium would be a mistake.



In the early 20th century, French architect André Godard wrote that Isfahan "is above all a plan, with lines and masses and sweeping perspectives."

"But there are new forces at work," he notes.

Jabal-Ameli's new forces include not only city officials but developers who want to build a 54-floor skyscraper hotel and shopping center just outside the historic district. Isfahan's deputy mayor, Hussein Jafari, says foreign tourists want modern hotels and points out that this one would be sited far enough from the city's core to escape Unesco's ire. At the same time, he says, the city government intends to rescue the thousands of decaying houses. "We can do both," Jafari insists.

"We're ready to invite investors from abroad to convert these houses into hotels, traditional restaurants and teahouses for tourists," says Farhad Soltanian, a cultural heritage official who works in the Armenian quarter. Soltanian takes me across the newly cobbled alley to a century-old Catholic church, now being restored through an unlikely alliance of the Vatican and the Iranian government. On the next street, workers are putting finishing touches on a grand mansion once home to Armenian clergy and now being restored with private funds. The owners hope the mansion, with its 30 freshly painted rooms, will draw foreign tourists and pay off their investment.

THE DAY I'M TO DEPART, Mazaheri and Moslemzadeh invite me to be their guest at a traditional dining hall on the Maidan. Isfahanis themselves joke about their reputation for being clever but stingy. But they also are famed for their fabulous banquets. As long ago as 1330, Ibn Battuta noted they were "always trying to outdo one another in procuring luxurious viands . . . in preparation of which they display all their resources."

Little appears to have changed. In the shadow of the Imam Mosque and bathed in the soothing sounds of traditional music, we sit cross-legged on wide benches and feast on *dizi*—an intricate Persian dish consisting of soup, bread, lamb and vegetables and served with a sizable mallet used to crush the contents. Stained-glass windows filter red and blue light across the room. Despite economic hardship, intractable politics and even the threat of war, something of Isfahan's ability to hold stubbornly to its traditions also shines through.

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EMBATTLED EXCAVATOR

Fossil prospector Ron Frithiof (with a mosasaur from his collections) was sued over a *T. rex* that he uncovered. "This whole experience," he says, "has been a disaster."

THE DINO WARS

Across the Great Plains and West, prospectors—and poachers—are excavating fossils in a cash-fueled free-for-all that often pits them against scientists and the law

BY DONOVAN WEBSTER

PHOTOGRAPHS BY AARON HUEY

BURIED BENEATH A BARREN stretch of South Dakota badland, the deceased appeared small for its species. As Ron Frithiof, an Austin, Texas, real-estate developer turned dinosaur prospector, dug cautiously around it in a rugged expanse of backcountry, he was growing increasingly confident that he and his partners were uncovering a once-in-a-lifetime find.

Ever since he had heard about a private collection going up for sale in the mid-1990s, Frithiof, now 61, had been hunting dinosaurs. "I'd thought fossils were things you could see only in museums," he says. "When I learned you could go out and find stuff like that, to keep or even to sell, it just lit a fire in my imagination. I studied every book I could, learned techniques of extraction. Fossils inspire a powerful curiosity."

Frithiof was keenly aware that the skeleton of a mature *Tyrannosaurus rex* ("Sue," named in honor of prospector Sue Hendrickson, who made the find in western South Dakota in 1990) had been auctioned off—at Sotheby's in New York City in 1997—for more than $8 million. The specimen that Frithiof and his fellow excavators began unearthing in 1998, in a painstaking, inch-by-inch dig was about four feet tall, less than half Sue's height. With unfused vertebrae and scrawny shin and ankle bones, the skeleton was almost certainly that

of a juvenile. If so, it would likely be the most complete young *T. rex* ever discovered. A find of this magnitude, Frithiof knew, would create a sensation. Its value would be, as he put it, "anyone's guess." $9 million? $10 million? This was uncharted territory.

For nearly three years, the excavators—including longtime fossil hunter Kim Hollrah, who had first investigated the site—continued their meticulous work. Whenever Frithiof, Hollrah and their companions could coordinate time off from work, they would drive 24 hours straight, from Texas to the dig site, north of Belle Fourche, South Dakota, which Frithiof had leased from a local rancher in 1998. "Most years, we'd spend about a month working," he recalls. "Thirty or 40 days a summer, before the weather would drive us off."

Braving blistering 100-degree temperatures, the crew took every precaution to keep the specimen intact. At the same time, they were attempting to wrest it from the ground before South Dakota's brutal winter set in. "That's one of the paradoxes of fossil collecting," says Frithiof. "Once a speci-

"Once a specimen is exposed to the elements, it's a race to get it out in as responsible a way as possible, to protect it from wind and rain and weathering. It's like a slow-motion race," says Frithiof.

men is exposed to the elements, it's a race to get it out in as responsible a way as possible, to protect it from wind and rain and weathering. It's like a slow-motion race."

Paleontological excavation is nothing if not grueling. "We worked inch by inch, brushing bits of rock and soil away, taking a pin to strip away just that next little bit of rock and earth [to reveal the rough contours]," Frithiof told me. On a good day, an experienced fossil excavator might uncover only a few inches of skeleton. Frithiof and the others gingerly pried out each section, still enclosed in the crumbly chunk of rock matrix that had originally surrounded it. In preparation for transport, the prospectors then wrapped the sections in layers of tissue paper, aluminum foil and plaster.

As the dig moved forward, Frithiof's colleagues, with a nod to "Sue" (today a centerpiece attraction at Chicago's Field Museum), decided the new *T. rex* needed a name. The one they came up with honored Frithiof's role as the project's financial backer. "I don't know why my parents started calling me Tinker," says Frithiof. "Somehow, it stuck."

IN 2001, AS THE EXCAVATION of Tinker headed toward completion, the team made another remarkable discovery: evidence of two additional *T. rex* skeletons on the site. By that point, a children's museum in the Midwest had indicated its willingness to pay up to $8.5 million for Tinker. During the prospective purchaser's pre-transaction research, however, a massive legal hiccup was uncovered—one that Frithiof and his lawyers would later insist had been an honest mistake.

Tinker, as it turned out, had been found not from local rancher Gary Gilbert's land but from adjacent property owned by Harding County, South Dakota. In November 2000, Frithiof, he says, with an eye to future excavations, had leased the parcel from the county; the agreement stipulated that the county would get 10 percent of the sale price for any fossils uncovered there. Now, in August 2004, Harding County filed a civil lawsuit in Federal District Court against Frithiof and his partners alleging fraud, trespass and conspiracy.

Frithiof's world caved in. After devoting years to Tinker, the prospector was suddenly in danger of going to jail for his efforts. "This whole experience has been a disaster," he says. "[With] all the lawyers' fees, not to mention the disruption of my life, it's cost me a fortune. And it's been very

Writer **DONOVAN WEBSTER** *lives in Charlottesville, Virginia. Photographer* **AARON HUEY** *is based in Seattle, Washington.*

UNEARTHING DINOSAURS

While plenty of amateur and commercial digs have been free of controversy (above: tourists in South Dakota pay to help excavate a *T. rex*), many others, including the dig near Belle Fourche, South Dakota, where Frithiof and his partners uncovered a juvenile *T. rex,* have become the focus of protracted and heated litigation. (Opposite: paleontologist Rob Sula surveys the Belle Fourche site.) "That fossil," says Joe Ellingson, who is Frithiof's attorney, "it's wrecked my client's life."

hard on my family. You gotta remember, I've never been in trouble in my life. Not even a traffic ticket." The disputed dinosaur, according to Frithiof's attorney Joe Ellingson, "wrecked my client's life."

Moreover, the fossil was consigned to limbo. As a result of byzantine twists in the litigation, Tinker's bones would soon be placed under another lawyer's supervision, stored in plastic tubs at an undisclosed location in Harrisburg, Pennsylvania—1,400 miles from the excavation site.

ACROSS THE AMERICAN WEST and Great Plains, an intensifying conflict over the excavation of fossils—everything from a five-inch shark's tooth, which might sell for $50, to Frithiof's spectacular *T. rex*—has pitted amateur excavators against both the federal government and scientists. Scores, perhaps thousands, of prospectors—some operating as poachers on federally protected land—are conducting digs across hundreds of thousands of square miles from the Dakotas to Texas, Utah, Wyoming and Montana.

"In terms of digging for fossils, there are a lot more people" than there used to be, says Matthew Carrano, curator of dinosauria at the Smithsonian Museum of Natural History. "Twenty years ago, if you ran into a private or commercial fossil prospector in the field, it was one person or a couple of people. Now, you go to good fossil locations in, say, Wyoming, and you find quarrying operations with maybe 20 people working, and doing a professional job of excavating fossils."

Fueling the frenzy is skyrocketing market demand, as fossils, long relegated to the dusty realm of museum shelves, have entered the glitzy spheres of home décor and art. "There have always been private fossil collectors," says David Herskowitz of Heritage Auction Galleries in Dallas. "The difference is, historically, a private fossil collector was wealthy. But today, interest in fossils has grabbed the attention of a broad swath of the population. That means a lot more people are collecting."

Who's buying these days? Just about anyone. With prices to suit virtually any budget, one can own an ancient remnant of life on earth: a botanical fossil, such as a fern,

UPPER RIGHT: FRANCOIS GOHIER / PHOTO RESEARCHERS; MAP: GUILBERT GATES

may cost as little as $20; a fossil snail, perhaps, may well go for $400.

The real action, however, is in the big vertebrates: dinosaurs that roamed the earth between 65 million and 220 million years ago. These are the specimens attracting the high rollers—serious collectors. Actors Harrison Ford and Nicolas Cage, for example, are rumored to have impressive collections.

The paleo-passion, however, extends far beyond celebrities. "The group who used to be serious fossil collectors—that's really grown," says money manager Charles Lieberman of Advisors Capital Management in Hasbrouck Heights, New Jersey. At his office, Lieberman displays several impressive specimens, including a three-foot-long Cretaceous herbivore, *Psittacosaurus*. "Since the book and movie *Jurassic Park*," he adds, "interest in fossil collecting has gone into overdrive, affecting demand and elevating prices."

The rise in prices is fueling the prospecting boom in the Great Plains and West—not necessarily because of a higher concentration of fossils there, but because the American West is one of the world's easiest places to find them. "If you had flown around the world 150 million years ago, the West wouldn't be more populated by dinosaurs than anywhere else," says the Smithsonian's Carrano. "But in the West, the rock layers laid down during the age of dinosaurs are currently exposed. It also helps that the landscape is dry, so there's not a lot of vegetation covering the rock. And it's erosive, so new rock is constantly being uncovered."

While fossils can now be found in stores from Moab to Manhattan, the most unusual (and valuable) specimens tend to show up at auction houses—or vanish into the shadowy world of private purchasers, some of whom are buying on the black market. "You go to the Tucson Gem and Mineral Show every year," says Carrano, "and if you spend the week building trust with some of the sellers, you'll get invited back to a hotel room and be shown exquisite fossil specimens that were probably taken illegally. We're talking museum-grade specimens that are going to disappear into private collections."

EARTHLY TREASURES

While dinosaur skeletons fetch millions at auction, rock shops (above: wares at an Arizona fossil store) offer more affordable finds (left: an ammonite, or mollusk, likely from the Cretaceous, sells for $109.) "Since the book and movie *Jurassic Park*," says collector Charles Lieberman, "fossil collecting has gone into overdrive."

The auction houses, of course, make sure their offerings come with documented provenance. In only a few hours in April 2007, Christie's in Paris gaveled off fossils worth more than $1.5 million—including a dinosaur egg that went for $97,500 and the fossilized skeleton of a Siberian mammoth that fetched $421,200. In December 2007, a 70-million-year-old mosasaur a—30-foot carnivorous underwater reptile excavated in North Africa—brought more than $350,000 at Los Angeles auctioneer Bonhams & Butterfields. In January 2008,

{ CONTINUED ON PAGE 53 }

KELLY RIGBY / BLM PHOTO

Heritage Auction Galleries in Dallas sold the largest mastodon skull ever found for $191,000 and a 55-million-year-old lizard from the Dominican Republic, its flesh and skin preserved in amber, for $97,000. "The day's tally was $4.187 million," says auction director Herskowitz. "While I can't disclose who my buyers were, I can say many of them have small to substantive museums on their properties."

Then there's eBay. When I logged on recently, I discovered 838 fossil specimens for sale, including a spectacular ammonite—an ancestor of today's chambered nautilus—expected to go for upward of $3,000. Very little was disclosed about where any of the fossils came from. "Here's what I can tell you about eBay," says Carrano. "If a fossil being sold there comes from Morocco, China, Mongolia, Argentina or a number of other nations, at some point it was part of an illegal process, since those countries don't allow commercial fossil export."

In the United States, the law regulating fossil excavation and export is far from straightforward. Property statutes state that any fossil taken with permission from privately owned land may be owned and sold—which is why legitimate excavators usually harvest fossils from individual landowners. A complex series of regulations apply to fossils removed from federal and state land (including Bureau of Land Management [BLM] tracts, national forests and grasslands, and state and national parks) and what are known as jurisdictional lands—for example, the public land held by Harding County, South Dakota.

> **"Newly harvested fossils** are flooding the commercial market," says Larry Shackelford, a special agent with the BLM in Salt Lake City. "Running down each one and checking where it came from? We don't have the manpower."

SNARING POACHERS

Federal agents (analyzing a dinosaur specimen in Utah) are charged with policing prospectors across some 500 million acres. "Nobody knows how much fossil material is being taken off public lands and smuggled out," says paleontologist James Clark. "We don't know the scale of what's being lost."

To complicate matters, some fossil materials—limited amounts of petrified wood or fossil plants, for example—may be removed from certain public lands without oversight or approval. In most cases, however, permits are required; applications are reviewed according to a time-consuming process. Prospectors who want to cash in quickly on a single find are often reluctant to abide by the law. Given that there are nearly 500 million acres of publicly held land in the United States (two-thirds of which contain some of the best excavation zones in the world), prospectors who dig illegally are not often caught. "Newly harvested fossils are flooding the commercial market," says Larry Shackelford, a special agent with the BLM in Salt Lake City. "Running down each one and checking where it came from? We don't have the manpower."

In fact, law enforcement officials can barely keep up with prosecutions already underway. Although state and federal officials may not discuss cases currently in litigation, they acknowledge that volume is increasing. "In most districts, we easily see one or two new leads a month," says Bart Fitzgerald, a BLM special agent in Arizona. "Mostly

these become civil cases. We understand that enthusiasm gets the best of people sometimes. Someone finds an amazing fossil and they take it home. Mostly we just want to recover the fossil—it's government property. But once in a while, we see a case where clearly the intent was criminal: where people were knowingly extracting fossils from public land for private profit. Those we prosecute criminally."

A MAJOR CRIMINAL CASE began unfolding in 2006, when a largely intact *Allosaurus*—a meat-eating older cousin of *T. rex*—was taken from public land in Utah. The excavator went to great lengths to look legitimate, including creating bogus letters of provenance. The dinosaur bones were first transported from Utah to a U.S. buyer, then to a purchaser in Europe, before finally being sold to a collector in Asia. In February 2007, the *Allosaurus* poacher—who had been turned in anonymously—was convicted on one count of theft of federal property.

Several years earlier, a high-profile case involved paleoprospector Larry Walker, who discovered a cache of fossil *Therizinosaurs*—a rare dinosaur/bird hybrid—in the desert outside his Moab, Utah, hometown. Working at night beneath camouflage netting, Walker excavated 30 to 40 of the creatures' distinctive ripping claws, then sold the specimens at the Tucson Gem and Mineral Show for a total take of roughly $15,000.

"He knew what he was doing was illegal," says Loren Good, a special agent for the BLM's Idaho district. "Working with the FBI, we did a joint investigation into the source of the claws and prosecuted Mr. Walker. He received a ten-month incarceration and a $15,000 fine."

"These cases come in all forms," says the BLM's Fitzgerald. "Take the example of some tour operators in Montana. They took a group of tourists out recently on a fossil-hunting trip, strayed onto public land and extracted fossils from a good site there. Was it an honest mistake or a calculated commercial move?" Fitzgerald asks. "After all, the tour operators carried GPS units; they knew precisely where they were." (Charges have not yet been filed.)

IN THE TINKER CASE, the prosecution claimed that Frithiof knew he was on county property when he found the Tinker specimen, that he had signed the agreement with Harding County without informing officials of the find and that he had negotiated a perhaps $8.5 million sale without telling the coun-

DEVOURING HISTORY

Researchers worry that commercial digs (left: an excavation in Utah) will obliterate the scientific record. "A lot of guys out there don't care about the site where the fossil sits," says paleontologist Mark Norell. Because destructive haste is commonplace, he adds, "we lose the context of the site as well as the fossil itself."

ty. "Harding County believes Mr. Frithiof first discovered the specimen's location, then induced the county into a lease, knowing the value of what existed on the property without disclosing it to us," says Ken Barker, a Belle Fourche, South Dakota, attorney retained by the county to prosecute the case. "Because of this, we seek to void the lease agreement, entered into fraudulently, and to recover the county's property."

Frithiof sees things differently. It wasn't until the prospective purchaser's survey in 2001, he says, that all parties learned that the Tinker site was on county land. "We were something like 100 feet across the [county] property boundary," he says. "Even the rancher we were working with believed we were on his land. It was an honest mistake. And I already had a lease on that land with Harding County.

"It wasn't like we were sneaking around," Frithiof adds. "Our find had been in the newspaper. We'd been on the Discovery Channel. We'd had prominent paleontologists, like Bob Baaker from the University of Montana, out to look at it. What we were doing was all out in the open. Nobody thought we were doing anything illegal . . . at all."

In June 2006, Judge Richard Battey of the United States District Court voided the agreement between Frithiof and the county and ruled, on the basis of a technicality, that Tinker belonged to Harding County. Frithiof appealed. In September 2007, a United States Court of Appeals panel reversed the decision. The Tinker fossil, they ruled, was Frithiof's property; only the original contract's 10 percent payment was owed to Harding County. The appeals court then sent the case back to Federal District Court for final disposition. Frithiof had no choice but to wait.

In the meantime, the location of Tinker—and the fossil's condition—had become a source of contention. Before the legal wrangling began, Frithiof had delivered sections of the skeleton to private curators Barry and April James, who specialized in preparation of paleontological specimens for display, at their Sunbury, Pennsylvania, firm, Prehistoric Journeys. (The process involves removal of the stone matrix encasing the excavated bones.) Once the litigation proceeded, however, the Jameses, who say they had put $200,000 worth of labor and more than two years into the project, were barred from completing the work or collecting payment from Frithiof. Their company filed for bankruptcy in 2005.

"Now I have the Tinker fossil in my possession," says Larry Frank, a Harrisburg, Pennsylvania, attorney who is trustee of the James bankruptcy. "I've filed an artisans' lien against the value of the specimen. Until the matter is resolved, the skeleton will sit in large plastic containers in my possession. We believe that's a good, safe place for it."

FOR SCIENTISTS, commercial excavation of fossils—legal or not—raises troubling questions. "For me," says Mark Norell, chairman and curator of vertebrate paleontology at the American Museum of Natural History in New York City, "the big concern with all this private digging is that it may be robbing science of valuable knowledge."

> **You'll get invited back** to a hotel room and be shown exquisite fossil specimens that were probably taken illegally. We're talking museum-grade specimens that are going to disappear into private collections."

Norell believes that anyone harvesting fossils "needs to be considerate of scientific data surrounding the specimen." Context is important. "A lot of the guys out there digging commercially are just cowboys; they don't care about the site where the fossil sits, how it's oriented in the earth, what can be found around it to give us clues to what the world was like when that fossil animal died." Some commercial excavators "want only to get the specimen out of the ground and get paid—so we lose the context of the site as well as the fossil itself."

The Smithsonian's Carrano says all scientifically significant fossil specimens, whether from public or private lands, should be placed into museums for study in perpetuity. "Any unique fossil has more value scientifically and educationally than we can ever place a cash value on," he adds. "In a perfect world, there'd be a way to vet every fossil collected: the significant ones would be retained and studied; others could go to commercial use. Not every fossil shark's tooth is significant, but some are. Let's retain those significant ones for study."

For the past several years, the Society of Vertebrate Paleontology, one of the fossil world's preeminent professional organizations, has lobbied in support of Congressional legislation that would protect fossils taken from public lands. Since 2001, a bill introduced by Representative James McGovern, Democrat of Massachusetts—the Paleontological Resources Preservation Act—has languished in both the House and Senate. The delay, some proponents believe, stems from some western lawmakers' reluctance to add any regulations regarding public lands. If passed into law, the act would require that only trained, federally certified professionals be allowed to extract fossils from public lands—and would substantially increase penalties for illegal fossil excavation.

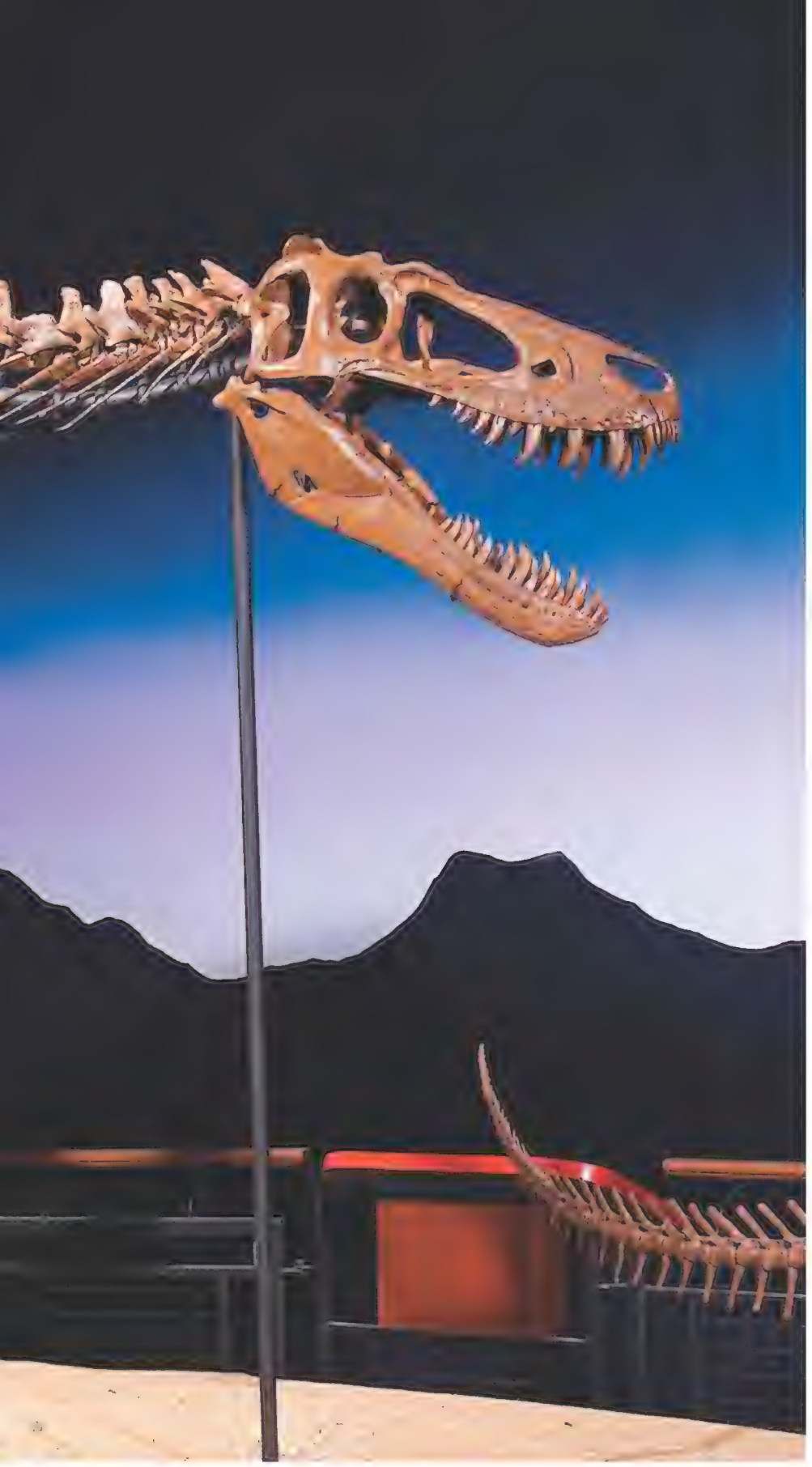
T. REX JUNIOR

In 2002 in Montana, a team of researchers from the Burpee Museum in Rockford, Illinois, unearthed a 21-foot-long juvenile *T. rex* (above) similar to the one found by Frithiof. The discovery, scientist Mike Henderson said at the time, was "akin to finding a gold mine."

The proposed legislation has galvanized critics, from mining company executives to paleontology prospectors, many of whom argue that improved enforcement of existing laws is all that is needed. "This new bill provides no funding for additional federal agents to police these areas, meaning it has no teeth," says Jack Kallmeyer, a paleontological prospector. "As long as there is demand for the commodity, without sufficient enforcement personnel, nothing will stop illegal collecting."

Kallmeyer also notes that proposed and existing fossil-extraction laws do not address a critical threat to the nation's fossil heritage. "There are a number of dinosaur and [other] vertebrate fossils out there [on public lands] that are not rare. Professional paleontologists aren't in-

For more on dinosaurs, go to Smithsonian.com/dinosaurs



BURPEE MUSEUM OF NATURAL HISTORY

terested in excavating them, as those specimens are well known and well studied. Why shouldn't amateur or commercial collectors be allowed to extract those?" Fossils left exposed over years, Kallmeyer adds, will eventually erode away.

But paleontologist James Clark of George Washington University in Washington, D.C., who serves on the government liaison committee for the Society of Vertebrate Paleontology, disagrees. "Nobody knows how much fossil material is being taken off public lands and smuggled out," he says. "We don't know the scale of what's being lost." Clark, who sees the proposed federal bill as a step forward, believes that existing legislation is too nonspecific and confusing. "As it stands now, the situation is a free-for-all," he says.

THROUGH THE WINTER of 2007-2008, as Frithiof awaited another ruling from Federal District Court, he and lawyer Joe Ellingson hunkered down. "We don't want to say much," Ellingson told me. "We don't want to antagonize anyone in any way. We just want to wait and get our ruling."

The delay, however, proved excruciating for Frithiof, who continued living near Austin, selling real estate. "There's not one hour," he says, "that it wasn't in the back of my mind. And that takes a toll. Even a physical toll." Frithiof says he developed cardiac problems. "I just want this all to be over," he says, "so I can go back to my site and keep working. We've found evidence of two other *T. rex* specimens there, but we don't know if they're complete or not. We've covered them up to protect against the elements. Until all this is resolved, we've been barred from working."

At last, on February 5, 2008, Judge Battey ruled that Frithiof's lease with Harding County was legal and enforceable. Frithiof owned Tinker, though he would have to give the county 10 percent of any profits from its sale. Harding County, the decree said, "knowingly entered into this contract, and now must live with the consequences of its actions." For Frithiof, the ruling meant "a huge weight had disappeared off my life."

But within weeks of the ruling, Harding County appealed yet again, sending the case back into court and consigning Frithiof once again to legal limbo. After more than four years of litigation, disposition of the appeal is expected within weeks. "This experience has removed the joy of fossil hunting for me," says Frithiof. "I haven't done one day of digging since the day initial charges were brought."

"In a perfect world, there'd be some way to vet every fossil collected: the significant ones would be retained and studied; the others could go to commercial use. Not every fossil shark's tooth is significant, but some are."

And yet, Frithiof tells me, an even larger question preoccupies him. "My thoughts always return to the exposed fossils out there on our public land," he adds. "Fossils that are going unexcavated due to lack of interest. The ones paleontologists are never going to extract because they are fossils that are too common, but which some collector might cherish."

Frithiof insists that careful amateur excavators can make a significant contribution to science. "The fossils are out there, wind and rain weathering them, while people argue about who is allowed to collect them and who isn't. After a year or two of exposure, any fossil begins to disintegrate and crumble to dust." And then, he adds, "Well, nobody gets them. They're just gone."

COOK vs.

A century ago, Frederick Cook and Robert Peary each said they discovered the North Pole. Now the question is: How did Peary's claim trump Cook's?

BY BRUCE HENDERSON

PEARY

ON SEPTEMBER 7, 1909,

readers of the *New York Times* awakened to a stunning front-page headline: "Peary Discovers the North Pole After Eight Trials in 23 Years." The North Pole was one of the last remaining laurels of earthly exploration, a prize for which countless explorers from many nations had suffered and died for 300 years. And here was the American explorer Robert E. Peary sending word from Indian Harbour, Labrador, that he had reached the pole in April 1909, one hundred years ago this month. The *Times* story alone would have been astounding. But it wasn't alone.

A week earlier, the *New York Herald* had printed its own front-page headline: "The North Pole is Discovered by Dr. Frederick A. Cook." Cook, an American explorer who had seemingly returned from the dead after more than a year in the Arctic, claimed to have reached the pole in April *1908*—a full year before Peary.

Anyone who read the two headlines would know that the North Pole could be "discovered" only once. The question then was: Who had done it? In classrooms and textbooks, Peary was long anointed the discoverer of the North Pole—until 1988, when a re-examination of his records commissioned by the National Geographic Society, a major sponsor of his expeditions, concluded that Peary's evidence never proved his claim and suggested that he knew he might have fallen short. Cook's claim, meanwhile, has come to rest in a sort of polar twilight, neither proved nor disproved, although his descriptions of the Arctic region—made public before Peary's—were verified by later explorers. Today, on the centennial of Peary's claimed arrival, the bigger question isn't so much who as how: *How* did Peary's claim to the North Pole trump Cook's?

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20me Année — Numéro 987
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PÔLE NORD
LA CONQUÊTE DU POLE NORD
Le docteur Cook et le commandant Peary s'en disputent la gloire

Peary (below: in the Arctic, 1909) and Cook started as friends. Their dispute made international news (above: a 1909 French magazine).

In 1909, the journalist Lincoln Steffens hailed the battle over Peary's and Cook's competing claims as the story of the century. "Whatever the truth is, the situation is as wonderful as the Pole," he wrote. "And whatever they found there, those explorers, they have left there a story as great as a continent."

THEY STARTED OUT AS FRIENDS AND SHIPMATES. Cook had graduated from New York University Medical School in 1890; just before he received his exam results, his wife and baby died in childbirth. Emotionally shattered, the 25-year-old doctor sought escape in articles and books on exploration, and the next year he read that Peary, a civil engineer with a U.S. Navy commission, was seeking volunteers, including a physician, for an expedition to Greenland. "It was as if a door to a prison cell had opened," Cook would later write. "I felt the first indomitable, commanding call of the Northland." After Cook joined Peary's 1891 Greenland expedition, Peary shattered his leg in a shipboard accident; Cook set Peary's two broken bones. Peary would credit the doctor's "unruffled patience and coolness in an emergency" in his book *Northward Over the Great Ice*.

For his part, Peary had come by his wanderlust after completing naval assignments overseeing pier construction in Key West, Florida, and surveying in Nicaragua for a proposed ship canal (later built in Panama) in the 1880s. Reading an account of a Swedish explorer's failed attempt to become the first person to cross the Greenland ice cap, Peary borrowed $500 from his mother, outfitted himself and bought passage on a ship that left Sydney, Nova Scotia, in May 1886. But his attempt to cross the cap, during a summer-long sledge trip, ended when uncertain ice conditions and dwindling supplies forced him back. Upon returning to a new

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NORTH WIND PICTURE ARCHIVES; PP. 58-59 GALEN ROWELL / CORBIS; P. 59 GRANGER COLLECTION, NEW YORK

Cook (top left: on Mt. McKinley, and top right: perhaps in a studio) said he had summited Mt. McKinley, a boast Peary would later attack. (Above: their claimed routes to the North Pole.)

Navy assignment in Washington, D.C., he wrote his mother, "My last trip brought my name before the world; my next will give me a standing in the world. . . . I will be foremost in the highest circles in the capital, and make powerful friends with whom I can shape my future instead of letting it come as it will. . . . Remember, mother, I *must* have fame."

Peary, born in 1856, was one of the last of the imperialistic explorers, chasing fame at any cost and caring for the local people's well-being only to the extent that it might affect their usefulness to him. (In Greenland in 1897, he ordered his men to open the graves of several natives who had died in an epidemic the previous year—then sold their remains to the American Museum of Natural History in New York City as anthropological specimens. He also brought back living natives—two men, a woman and three youngsters—and dropped them off for study at the museum; within a year four of them were dead from a strain of influenza to which they had no resistance.)

Cook, born in 1865, would join a new wave of explorers who took a keen interest in the indigenous peoples they came across. For years, in both the Arctic and the Antarctic, he learned their dialects and adopted their diet.

Differences between the two men began to surface after their first trip to Greenland. In 1893, Cook backed out of another Arctic journey because of a contract prohibiting any expedition member from publishing anything about the trip before Peary published his account of it. Cook wanted to publish the results of an ethnological study of Arctic natives, but Peary said it would set "a bad precedent." They went their separate ways—until 1901, when Peary was believed to be lost in the Arctic and his family and supporters turned to Cook for help. Cook sailed north on a rescue ship, found Peary and treated him for ailments ranging from scurvy to heart problems.

Cook also traveled on his own to the Antarctic and made two attempts to scale Alaska's Mount McKinley, claiming to be the first to succeed in 1906. Peary, for his part, made another attempt to reach the North Pole in 1905-06, his sixth Arctic expedition. By then, he had come to think of the pole as his birthright.

Any endeavor to reach the pole is complicated by this fact: unlike the South Pole, which lies on a landmass, the North Pole lies on drifting sea ice. After fixing your position at 90 degrees north—where all directions point south—there is no way to mark the spot, because the ice is constantly moving.

COOK'S EXPEDITION TO THE POLE DEPARTED Gloucester, Massachusetts, in July 1907 on a schooner to northern Greenland. There, at Annoatok, a native settlement 700 miles from the pole, he established a base camp and wintered over. He left for the pole in February 1908 with a party of nine natives and 11 light sledges pulled by 103 dogs, planning to follow an untried but promising route described by Otto Sverdrup, the leader of an 1898-1902 Norwegian mapping party.

OHIO STATE UNIVERSITY ARCHIVES; BETTMANN / CORBIS; MAP: GUILBERT GATES

According to Cook's book *My Attainment of the Pole*, his party followed the musk ox feeding grounds that Sverdrup had observed, through Ellesmere and Axel Heiberg islands to Cape Stallworthy at the edge of the frozen Arctic Sea. The men had the advantage of eating fresh meat and conserving their stores of pemmican (a greasy mixture of fat and protein that was a staple for Arctic explorers) made of beef, ox tenderloin and walrus. As the party pushed northward, members of Cook's support team turned back as planned, leaving him with two native hunters, Etukishook and Ahwelah. In 24 days Cook's party went 360 miles—a daily average of 15 miles. Cook was the first to describe a frozen polar sea in continuous motion and, at 88 degrees north, an enormous, "flat-topped" ice island, higher and thicker than sea ice.

For days, Cook wrote, he and his companions struggled through a violent wind that made every breath painful. At noon on April 21, 1908, he used his custom-made French sextant to determine that they were "at a spot which was as near as possible" to the pole. At the time, speculation about what was at the pole ranged from an open sea to a lost civilization. Cook wrote that he and his men stayed there for two days, during which the doctor reported taking more observations with his sextant to confirm their position. Before leaving, he said, he deposited a note in a brass tube, which he buried in a crevasse.

The return trip almost did them in.

Cook, like other Arctic explorers of the day, had assumed that anyone returning from the pole would drift eastward with the polar ice. However, he would be the first to report a *westerly* drift—after he and his party were carried 100 miles west of their planned route, far from supplies they had cached on land. In many places the ice cracked, creating sections of open water. Without the collapsible boat they had brought along, Cook wrote, they would have been cut off any number of times. When winter's onslaught made travel impossible, the three men hunkered down for four months in a cave on Devon Island, south of Ellesmere Island. After they ran out of ammunition, they hunted with spears. In February 1909, the weather and ice improved enough to allow them to walk across frozen Smith Sound back to Annoatok, where they arrived—emaciated and arrayed in rags of fur—in April 1909, some 14 months after they had set out for the pole.

At Annoatok, Cook met Harry Whitney, an American sportsman on an Arctic hunting trip, who told him that many people believed Cook had disappeared and died. Whitney also told him that Peary had departed from a camp just south of Annoatok on his own North Pole expedition eight months earlier, in August 1908.

Peary had assembled his customary large party—50 men, nearly as many heavy sledges and 246 dogs to pull them—for use in a relay sledge train that would deposit supplies ahead of him. He called this the "Peary system" and was using it even though it had failed him in his 1906 attempt, when the ice split and open water kept him from his caches for long periods. On this try, Peary again faced stretches of open water that could extend for miles. He had no boat, so his party had to wait, sometimes for days, for the ice to close up.

Peary's party advanced 280 miles in a month. When adjusted for the days they were held up, their average progress came to about 13 miles a day. When they were some 134 miles from the pole, Peary sent everyone back except four natives and Matthew Henson, an African-American from Maryland who had accompanied him on his previous Arctic expeditions. A few days later—on April 6, 1909—at the end of an exhausting day's march, Henson, who could not use a sextant, had a "feeling" they were at the pole, he later told the *Boston American*.

"We are now at the Pole, are we not?" Matthew Henson, a veteran Arctic explorer, asked Peary.

"We are now at the Pole, are we not?" Henson said he asked Peary.

"I do not suppose that we can swear that we are exactly at the Pole," Peary replied, according to Henson.

He said Peary then reached into his outer garment and took out a folded American flag sewn by his wife and fastened it to a staff, which he stuck atop an igloo his native companions had built. Then everyone turned in for some much-needed sleep.

The next day, in Henson's account, Peary took a navigational sight with his sextant, though he did not tell Henson the result; Peary put a diagonal strip of the flag, together with a note, in an empty tin and buried it in the ice. Then they turned toward home.

WHILE PEARY MADE HIS WAY SOUTH, Cook was recovering his strength at Annoatok. Having befriended Whitney, he told him about his trip to the pole but asked that he say nothing until Cook could make his own announcement. With no scheduled ship traffic so far north, Cook planned to sledge 700 miles south to the Danish trading post of Upernavik, catch a ship to Copenhagen and another to New York City. He had no illusions about the difficulties involved—the sledge trip would involve climbing mountains and glaciers and crossing sections of open water when the ice was in motion—but he declined Whitney's offer of passage on a chartered vessel due at summer's end to take the sportsman home to New York. Cook thought his route would be faster.

Etukishook and Ahwelah had returned to their village just south of Annoatok, so Cook enlisted two other natives to ac-

BRUCE HENDERSON *is the author of* True North: Peary, Cook and the Race to the Pole. *He teaches writing at Stanford University.*

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company him. The day before they were to leave, one of the two got sick, which meant that Cook would have to leave a sledge behind. Whitney suggested that he also leave behind anything not essential for his trip, promising to deliver the abandoned possessions to Cook in New York. Cook agreed.

In addition to meteorological data and ethnological collections, Cook boxed up his expedition records, except for his diary, and his instruments, including his sextant, compass, barometer and thermometer. He wouldn't be needing them because he would be following the coastline south. Leaving three trunk-size boxes with Whitney, Cook left Annoatok the third week of April 1909 and arrived a month later at Upernavik, where he told Danish officals of his conquest of the pole.

It was not until early August that a ship bound for Copenhagen, the *Hans Egede,* docked in Upernavik. For the three weeks it took to cross the North Atlantic, Cook entertained passengers and crew alike with spellbinding accounts of his expedition. The ship's captain, who understood the news value of Cook's claim, suggested he get word of it out. So on September 1, 1909, the *Hans Egede* made an unscheduled stop at Lerwick, in the Shetland Islands. At the town's telegraph station, Cook wired the *New York Herald*, which had covered explorers and their exploits since Stanley encountered Livingstone in Africa 30 years earlier. "Reached North Pole April 21, 1908," Cook began. He explained that he would leave an exclusive 2,000-word story for the newspaper with the Danish consul at Lerwick. The next day, the *Herald* ran Cook's story under its "Discovered by Dr. Frederick A. Cook" headline.

"Peary would allow nothing belonging to you on board," Harry Whitney wired Cook.

In Copenhagen, Cook was received by King Frederick. In gratitude for the Danes' hospitality, Cook promised in the king's presence that he would send his polar records to geography experts at the University of Copenhagen for their examination. "I offer my observations to science," he said.

WHILE COOK WAS STEAMING FOR COPENHAGEN, Harry Whitney waited in vain for his chartered vessel to arrive. Not until August would another ship stop in northern Greenland: the *Roosevelt*, built for Peary by his sponsors and named after Theodore Roosevelt. On board, Peary was returning from his own polar expedition, although up to that point he had told no one—not even the ship's crew—that he had reached the North Pole. Nor did he seem to be in any hurry to do so; the *Roosevelt* had been making a leisurely journey, stopping to hunt walrus in Smith Sound.

In Annoatok, Peary's men heard from natives that Cook and two natives had made it to the pole the previous year. Peary immediately queried Whitney, who said he knew only Cook had returned safely from a trip to the Far North. Peary then ordered Cook's two companions, Etukishook and Ahwelah, brought to his ship for questioning. Arctic natives of the day had no knowledge of latitude and longitude, and they did not use maps; they testified about distances only in relation to the number of days traveled. In a later interview with a reporter, Whitney, who unlike Peary was fluent in the natives' dialect, would say the two told him they had been confused by the white men's questions and did not understand the papers on which they were instructed to make marks.

Whitney accepted Peary's offer to leave Greenland on the *Roosevelt*. Whitney later told the *New York Herald* that a line of natives toted his possessions aboard under Peary's watchful gaze.

"Have you anything belonging to Dr. Cook?" Whitney told the newspaper Peary asked him.

Whitney answered that he had Cook's instruments and his records from his journey.

"Well, I don't want any of them aboard this ship," Peary replied, according to Whitney.

Believing that he had no choice, Whitney secreted Cook's possessions among some large rocks near the shoreline. The *Roosevelt* then sailed south with Whitney aboard.

On August 26, the vessel stopped at Cape York, in northwest Greenland, where a note from the skipper of an American whaler awaited Peary. It said that Cook was en route to Copenhagen to announce that he had discovered the North Pole on April 21, 1908. Native rumor was one thing; this was infuriating. Peary vented his rage to anyone who would listen, promising to tell the world a story that would puncture Cook's bubble. Peary ordered his ship to get underway immediately and make full speed for the nearest wireless station—1,500 miles away, at Indian Harbour, Labrador. Peary had an urgent announcement to make. On September 5, 1909, the *Roosevelt* dropped anchor at Indian Harbour. The next morning Peary wired the *New York Times*, to which he had sold the rights to his polar story for $4,000, subject to reimbursement if he did not achieve his goal. "Stars and Stripes nailed to North Pole," his message read.

Two days later, at Battle Harbour, farther down the Labrador coast, Peary sent the *Times* a 200-word summary and added: "Don't let Cook story worry you. Have him nailed." The next day, the *Times* ran his abbreviated account.

Arriving in Nova Scotia on September 21, Peary left the *Roosevelt* to take a train to Maine. At one stop en route, he met with Thomas Hubbard and Herbert Bridgman, officers of the Peary Arctic Club, a group of wealthy businessmen who financed Peary's expeditions in exchange for having his discoveries named for them on maps. The three men began

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to shape a strategy to undermine Cook's claim to the pole.

When they reached Bar Harbor, Maine, Hubbard had a statement for the press on Peary's behalf: "Concerning Dr. Cook . . . let him submit his records and data to some competent authority, and let that authority draw its own conclusions from the notes and records. . . .What proof Commander Peary has that Dr. Cook was not at the pole may be submitted later."

THE SAME DAY THAT PEARY ARRIVED IN NOVA SCOTIA, September 21, Cook arrived in New York to the cheers of hundreds of thousands of people lining the streets. He issued a statement that began, "I have come from the Pole." The next day he met with some 40 reporters for two hours at the Waldorf-Astoria hotel. Asked if he objected to showing his polar diary, Cook "showed freely" a notebook of 176 pages, each filled with "fifty or sixty lines of penciled writing in the most minute characters," according to accounts in two Philadelphia papers, the *Evening Bulletin* and the *Public Ledger*. Asked how he fixed his position at the pole, Cook said by measuring the sun's altitude in the sky. Would he produce his sextant? Cook said his instruments and records were en route to New York and that arrangements had been made for experts to verify their accuracy.

Four days later, he received a wire from Harry Whitney. "Peary would allow nothing belonging to you on board," it read. ". . . See you soon. Explain all."

Cook would later write that he was seized by "heartsickness" as he realized the implications of Whitney's message. Still, he kept giving interviews about his trek, providing details on his final dash to the pole and his year-long struggle to survive the return journey. Peary had told an Associated Press reporter in Battle Harbour that he would wait for Cook to "issue a complete authorized version of his journey" before making his own details public. Peary's strategy of withholding information gave him the advantage of seeing what Cook had by way of polar descriptions before offering his own.

In the short term, however, Cook's fuller accounts helped him. With the two battling claims for the pole, newspapers polled their readers on which explorer they favored. *Pittsburgh Press* readers supported Cook, 73,238 to 2,814. *Watertown* (N.Y.) *Times* readers favored Cook by a ratio of three to one. The *Toledo Blade* counted 550 votes for Cook, 10 for Peary. But as September turned to October, Peary's campaign against Cook picked up momentum.

FIRST, THE PEARY ARCTIC CLUB QUESTIONED COOK'S claim to have scaled Mount McKinley in 1906. For years a blacksmith named Edward Barrill, who had accompanied Cook on the climb, had been telling friends, neighbors and reporters about their historic ascent. But the Peary Arctic Club released an affidavit signed by Barrill and notarized on October 4 saying the pair had never made it all the way to the top. The document was published in the *New York Globe*—which was owned by Peary Arctic Club president Thomas Hubbard, who declared that the McKinley affair cast doubt on Cook's polar claim.

On October 24, the *New York Herald* reported that before the affidavit was signed, Barrill had met with Peary's representatives to discuss financial compensation for calling Cook a liar. The paper quoted Barrill's business partner, C. C. Bridgeford, as saying Barrill had told him, "This means from $5,000 to $10,000 to me." (Later, Cook's McKinley claim would be challenged by others and in more detail. Now, many members of the mountaineering community dismiss the notion that he reached the summit.)

A week after Barrill's affidavit appeared in the *Globe*, Peary released a transcript of the interrogation of Etukishook and Ahwelah aboard the *Roosevelt*. The men were quoted as saying they and Cook had traveled only a few days north on the ice cap, and a map on which they were said to have marked their route was offered as evidence.

THE DANISH EXPERTS ANNOUNCED THAT COOK'S CLAIM WAS "NOT PROVEN." MANY U.S. NEWSPAPERS AND READERS TOOK THAT TO MEAN "DISPROVED."

Also in October, the National Geographic Society—which had long supported Peary's work and put up $1,000 for the latest polar expedition—appointed a three-man committee to examine his data. One member was a friend of Peary's; another was head of the U.S. Coast and Geodetic Survey, to which Peary had been officially assigned for his final expedition, and the third had been quoted in the *New York Times* as "a skeptic on the question of the discovery of the Pole by Cook."

On the afternoon of November 1, the three men met with Peary and examined some records from his journey; that evening, they looked at—but according to Peary's own account did not carefully examine—the explorer's instruments in a trunk in the poorly lit baggage room of a train station in Washington, D.C. Two days later, the committee announced that Peary had indeed reached the North Pole.

By then, Cook had to cancel a lecture tour that he had just begun because of laryngitis and what he called "mental depression." In late November, drawing on his diary, he completed his promised report to the University of Copenhagen. (He chose not to send his diary to Denmark for fear of losing it.) In December, the university—whose experts had been expecting original records—announced that Cook's claim was "not proven." Many U.S. newspapers and readers took that finding to mean "disproved."

"The decision of the university is, of course, final," the

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U.S. minister to Denmark, Maurice Egan, told the Associated Press on December 22, 1909, "unless the matter should be reopened by the presentation of the material belonging to Cook which Harry Whitney was compelled to leave."

By then, the news coverage, along with the public feting of Peary by his supporters, began to swing the public to his side. Cook did not help his cause when he left for a yearlong exile in Europe, during which he wrote his book about the expedition, *My Attainment of the Pole*. Though he never returned to the Arctic, Whitney did, reaching northern Greenland in 1910. Reports conflict on how thoroughly he searched for Cook's instruments and records, but in any case he never recovered them. Nor has anyone else in the years since.

IN JANUARY 1911, PEARY APPEARED BEFORE THE NAVAL Affairs Subcommittee of the U.S. House of Representatives to receive what he hoped would be the government's official recognition as the discoverer of the North Pole. He brought along his diary of his journey. Several congressmen were surprised by what they saw—or didn't see—on its pages.

"A very clean kept book," noted Representative Henry T. Helgesen of North Dakota, wondering aloud how that could be, considering the nature of pemmican. "How was it possible to handle this greasy food and without washing write in a diary daily and at the end of two months have that same diary show no finger marks or rough usage?"

To this and other questions Peary gave answers that several subcommittee members would deem wanting. The subcommittee chairman, Representative Thomas S. Butler of Pennsylvania, concluded, "We have your word for it. . . . your word and your proofs. To me, as a member of this committee, I accept your word. But your proofs I know nothing at all about."

Peary (left: in 1919) retired from the Navy with the rank of rear admiral. Cook (right: in 1930) was convicted of mail fraud after he went into the oil business.

The subcommittee approved a bill honoring Peary by a vote of 4 to 3; the minority placed on the record "deep-rooted doubts" about his claim. The bill that passed the House and Senate, and which President William Howard Taft signed that March, eschewed the word "discovery," crediting Peary only with "Arctic exploration resulting in [his] reaching the North Pole." But he was placed on the retired list of the Navy's Corps of Civil Engineers with the rank of rear admiral and given a pension of $6,000 annually.

After what he perceived to be a hostile examination of his work, Peary never again showed his polar diary, field papers or other data. (His family consented to the examination of the records that led to the 1988 *National Geographic* article concluding that he likely missed his mark.) In fact, he rarely spoke publicly of the North Pole to the day he died of pernicious anemia, on February 20, 1920, at the age of 63.

The early doubts about Cook's claim, most of which emanated from the Peary camp, came to overshadow any contemporaneous doubts about Peary's claim. After Cook returned to the United States in 1911, some members of Congress tried in 1914 and 1915 to reopen the question of who discovered the North Pole, but their efforts faded with the approach of World War I. Cook went into the oil business in Wyoming and Texas, where in 1923 he was indicted on mail-fraud charges related to the pricing of stock in his company. After a trial that saw 283 witnesses—including a bank examiner who testified that Cook's books were in good order—a jury convicted him. "You have at last got to the point where you can't bunco anybody," District Court Judge John Killits berated Cook before he sentenced him to 14 years and nine months in prison.

While Cook was at the federal penitentiary in Leavenworth, Kansas, some of the land his now-dissolved oil company had leased was found to be part of the Yates Pool, the largest oil find of the century in the continental United States. Paroled in March 1930, Cook told reporters, "I am tired and I am going to rest." He spent his last decade living with his two daughters from his second marriage and their families. President Franklin D. Roosevelt pardoned Cook a few months before he died of complications from a stroke, on August 5, 1940, at the age of 75.

The notes that Peary and Cook reported leaving at the pole have never been found. The first undisputed overland trek to the North Pole wasn't made until 1968, when a party led by a Minnesotan named Ralph Plaisted arrived by snowmobile. But other explorers preceded Plaisted, arriving by air and by sea, and confirmed Cook's original descriptions of the polar sea, ice islands and the westward drift of the polar ice. So the question persists: How did Cook get so much right if he never got to the North Pole in 1908?

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What inspired Munch, van Gogh and Chaucer? What went wrong one terrible night in World War II? Astrophysicist Donald Olson probes historical mysteries with "forensic astronomy"

BY JENNIFER DRAPKIN AND SARAH ZIELINSKI

CELESTIAL SLEUTH

IN PAINTER EDVARD MUNCH'S *Girls on the Pier,* three women lean against a railing facing a body of water in which houses are reflected. A peach-colored orb appears in the sky, but, curiously, casts no reflection in the water. Is it the Moon? The Sun? Is it imaginary? Does it matter?

To Donald Olson, an astrophysicist at Texas State University, the answer to the last question is an emphatic yes. Olson solves puzzles in literature, history and art using the tools of astronomy: charts, almanacs, painstaking calculations and computer programs that map ancient skies. He is perhaps the leading practitioner of what he calls "forensic astronomy." But computers and math can take him only so far.

For *Girls on the Pier,* Olson and his research partner, Texas State physicist Russell Doescher, traveled to Asgardstrand, Norway, the resort town where Munch made the painting in the summer of 1901. By mapping the area and studying old postcards, the pair determined the exact location of the original pier (which had been torn down), the heights of the houses and the spot where Munch likely stood. They then retraced the paths of the Sun

PHOTO RESEARCHERS; DARREN CARROLL

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and the Moon across the sky at the time Munch was there.

They concluded that the setting Sun did not appear in that section of sky at that time, but the Moon did. As for the missing reflection, it was not an artistic choice, as some art historians had proposed, but a matter of optics: from the artist's perspective, the row of houses blocked it.

Reactions to the findings have varied. "Olson makes points that art historians have managed to miss, such as how Munch was a very careful observer of the natural world," says art historian Reinhold Heller, author of the 1984 biography *Munch: His Life and Work*. But Sue Prideaux, author of 2005's *Edvard Munch: Behind the Scream,* offers only caustic praise. "I think that it's absolutely splendid that two such learned scientists as Don Olson and Russell Doescher bend their considerable brainpower to decoding Munch rather in the manner of crossword addicts. Photographic fidelity was never Munch's aim." Prideaux adds that Munch was interested in capturing the feeling of a moment and that objective details were of little consequence to him. As he himself once wrote, "Realism is concerned only with the external shell of nature. . . . There are other things to be discovered, even broader avenues to be explored."

"You can't ruin a painting's mystique through technical analysis," Olson says. "It still has the same emotional impact. We are just separating the real from the unreal."

Olson, 61, began his scientific career exploring Einstein's theory of general relativity. He worked on computer simulations of the radiation near black holes and the distribution of galaxies. In other words, he spent his days inside a lab delving into topics that few people outside the lab understood. Then, one evening two decades ago, he and his wife, Marilynn, an English professor also at Texas State, attended a faculty party at which one of Marilynn's colleagues mentioned having difficulties with some passages in Chaucer's *Canterbury Tales*—they were loaded with astronomical references. Chaucer was no mere stargazer—he wrote an entire treatise on the astrolabe, an instrument used to calculate the positions of stars and planets—and sections of "The Franklin's Tale" deal in technical language with the prediction of a strange mammoth tide. Olson agreed to help decipher

Some art experts say that Olson (opposite) provides new insights into creativity (above: Munch's *Girls on the Pier* and the spot in Norway that is depicted in the painting).

the passages. "I can remember exactly where I was standing in the room because that moment changed my life," he says of accepting that challenge.

Analyzing computer simulations of the positions of the Moon and Sun, Olson surmised that a phenomenon described by Chaucer—"And by his magic for a week or more / It seemed the rocks were gone; he'd cleared the shore"—occurred in 1340. That year, when the Sun and Moon were at their closest points to Earth, they lined up in an eclipse of the Sun; their combined gravity caused extremely high tides off the coast of Brittany.

An exceptionally low tide, Olson calculated, grounded U.S. Marine landing craft on a reef in the World War II Battle of Tarawa.

"Most people see liberal arts on one side and sciences on the other, but I get to break those barriers down," Olson says, though he admits that he now gives relativity relatively short shrift. "I would love to know what happened before the Big Bang," he says, "but I don't think I'm smart enough to figure that out." He adds that he prefers "problems that are challenging but solvable."

Not long after Olson dealt with Chaucer, James Pohl, a history professor at Texas State and a former marine, came to him with a different sort of problem. Pohl had been studying the November 1943 Allied assault on the Pacific island of Tarawa, in which U.S. Marine landing craft were unexpectedly grounded on a coral reef about 600 yards offshore. The marines had to disembark and wade to the beach while exposed to heavy enemy fire. More than 1,000 were killed. Pohl wanted Olson to explain what had gone wrong.

Olson figured out that the marines' assault had taken place on one of two days that year when the Moon was farthest from Earth and also in its quarter phase, creating an unusually low tide. "When people have asked me who was to blame, I can tell them with confidence that the answer is no one," says Olson.

World War II war correspondent Robert Sherrod, who had been at the battle, presented Olson's conclusions at a reunion of Tarawa survivors and told Olson that the marines were gratified that there was a scientific explanation. And a military historian included the findings in his account of the battle.

While researching Tarawa, Olson came across another

RUSSELL DOESCHER; AKG-IMAGES

Using shadows and the Moon, Olson determined the moment Ansel Adams photographed *Autumn Moon* (above). When conditions recurred 57 years later, Olson was ready (opposite).

amphibious-landing mystery. In Julius Caesar's account of his invasion of Britain in 55 B.C., the general wrote that after seeing the enemy atop high cliffs (of Dover), he ordered his fleet to put ashore several miles away. But the exact location of where it landed has been debated by historians for centuries: historical descriptions seem to match a spot to the northeast, but currents that day would have taken the ships southwest.

Since coming across the puzzle 20 years ago, Olson has been collecting information about it, including a firsthand account of the battle by a Roman soldier. In 2007, Olson even sailed to the site himself to test conditions. That's when he figured out that Caesar had to have put in at a point to the northeast, near the town of Deal, as historical descriptions suggest. The date given in Caesar's history—or in the transcribed copies that remain—had to be wrong, and the landing must have taken place on August 22 or 23, not the 26th, as Caesar has it.

Olson published his Caesarean findings—one of the most recent of about 50 puzzles he has solved—in the August 2008 issue of *Sky & Telescope* magazine, whose readers (professional and amateur astronomers), he expects, check his calculations. (So far, he's not been found in error.)

Olson also investigated the sinking of the USS *Indianapolis* at the end of World War II. Two torpedoes from a Japanese submarine struck the heavy cruiser around midnight on July 30, 1945. The resulting explosion killed 300 sailors, and the ship sank in the Philippine Sea, casting 900 men into shark-infested waters. Only 317 survived to be rescued four days later. The Navy charged the ship's captain, Charles B. McVay, with negligence for failing to evade enemy fire. He was court-martialed and demoted, despite protests from men under his command that he was following standard procedures and testimony from the Japanese sub commander that McVay could not have escaped the attack. McVay committed suicide in 1968. He was exonerated in 2000 by a Congressional resolution that declared "the American people should now recognize Captain McVay's lack of culpability for the tragic

The USS *Indianapolis* (above: survivors in Palau) was torpedoed after being silhouetted in moonlight, according to Olson.

ANSEL ADAMS PUBLISHING RIGHTS TRUST / CORBIS; US NAVY / NARA / AP IMAGES

loss of the USS Indianapolis and the lives of the men who died."

The case piqued Olson's interest. After reading survivors' accounts, researching weather conditions and analyzing astronomical data at the time of the attack, Olson concluded that the submarine had surfaced just when the *Indianapolis* was in the glittering path of the Moon's reflection, allowing the Japanese to see it silhouetted from ten miles away but obscuring the submarine from the Americans' view. And once it was spotted, "the ship was doomed," he says.

IN ADDITION TO PUZZLES IN HISTORY, literature and art, Olson also likes photographic puzzles, such as the one he posed to students in an Astronomy in Art History and Literature course he taught at Texas State: When did Ansel Adams capture his celebrated Yosemite National Park image *Moon and Half Dome*? Although Adams kept careful technical records—noting shutter speeds, f-stops, lenses and film—he rarely dated his negatives, to the frustration of art historians. In the case of *Moon and Half Dome,* Adams noted only that he had taken it in 1960.

After a field trip to view Yosemite's cliffs and using clues from the photograph—the amount of snow on the ground, the phase of the Moon and the depth of the shadows on the granite dome—Olson and his students concluded that the photograph had been taken at 4:14 p.m. on December 28, 1960. And since they also determined that the Moon and Sun would be in nearly identical places at 4:05 p.m. on December 13, 1994, dozens of Adams fans and even a couple of the photographer's relatives, including his daughter-in-law and grandson, went to the park on that day to shoot their own versions of the iconic photograph.

Olson and another group of students took on Adams' *Autumn Moon,* a panorama of Yosemite Valley that had been dated in various books to either 1944 or 1948. A series of photographs of the valley taken by a park ranger in 2004 helped them pinpoint where Adams likely took the picture, while weather records and the angle of the Moon helped narrow down the day. Shadows in a color photograph of the scene that Adams took two and a half minutes before he made the black-and-white exposure (based on the position of the Moon) gave clues to the Sun's location and the time of the shot. Olson determined that it had been taken at 7:03 p.m. on September 15, 1948.

He was then able to predict when the light and seasonal conditions would be virtually identical, and he and hundreds of Adams fans ventured to the spot at the appointed time. At 6:52 p.m. on September 15, 2005, Olson's colleague Doescher snapped a photograph that looks eerily similar to Adams' masterpiece. "In a project like this, the journey is its own reward," says Olson. "We not only got to walk in Adams' footsteps, we got to understand the circumstances under which he took the photograph. And the truth is, I think he was prepared. I think he knew that moment in nature was coming."

That's Venus, not a star as is commonly believed, in van Gogh's *White House at Night*, painted weeks before the artist's suicide.

A STARRY SKY in a work of art often catches Olson's eye—he is an astronomer, after all—and starts him thinking about how he might identify the stars and just when they were captured. "He brings the power of the stars to bear upon our understanding," says art historian Paul Tucker of the University of Massachusetts at Boston. Tucker teaches Olson's work in his class because "pinpointing the time period or a particular moment can have real bearing on the meaning of a picture."

Olson has tackled three van Gogh paintings, including *White House at Night*, one of more than 70 that van Gogh created in Auvers-sur-Oise in the weeks before he committed suicide, on July 29, 1890. (He hasn't published

MUNCH MUSEUM, OSLO / ART RESOURCE, NY / ARTISTS RIGHTS SOCIETY, NY; THE HERMITAGE MUSEUM, ST. PETERSBURG

Critics say he's too literal, but Olson doesn't shy away from applying science to art. He says the livid sky in Munch's *The Scream* (opposite) wasn't imagined; the eruption of Krakatoa (left) had reddened sunsets worldwide.

any findings on van Gogh's *Starry Night*, saying it's "not simple" to identify the stars in the painting.) When Olson and several of his students traveled to the town, about 20 miles outside Paris, they discovered that the house identified in most guidebooks as the one in the painting didn't have the right number of windows and faced the wrong direction. Once they found the right house—after walking every street in town—it was relatively easy to deduce from celestial calculations and weather reports that the star in the *White House* painting was actually the planet Venus as it appeared above the house near sunset on June 16, 1890.

Olson delved into Munch's best-known work, *The Scream*, in 1995. About the time Munch painted it, in 1893, the artist wrote himself a note—which Olson read with the help of Norwegian dictionaries—about a walk he had taken at sunset years earlier, on which "a flaming sword of blood slashed open the vault of heaven—the atmosphere turned to blood—with glaring tongues of fire . . . and truly I heard a great scream."

In Oslo, Olson located the road featured in a sketch for the painting. Details in it—a cliff, a road with a railing and an island in a fjord—indicated to Olson that Munch must have been facing southwest when he drew it. Olson concluded that the painting's blood-red sky was no metaphor but the extraordinary aftereffects of the 1883 eruption of Mount Krakatoa in Indonesia, which sent so much gas and ash into the atmosphere that skies were darkened or colored worldwide for many months.

Some Munch experts have challenged Olson's interpretation. Biographer Prideaux points out that Munch expressed contempt for realism in painting and "stated that his purpose was to paint the vision of the soul." Furthermore, "you'd hardly call the figure [in *The Scream*] realist, so why the sky?" And art historian Jeffery Howe of Boston College notes that Munch didn't paint *The Scream* until ten years after Krakatoa erupted. Howe admits that Munch "might have remembered the scene and painted it later," as the artist's note suggests, but Howe remains unpersuaded.

Olson insists his finding doesn't diminish Munch's creation. "How many people in Europe saw the Krakatoa twilights?" he says. "It would be hundreds of thousands, even millions. And how many people created a painting that people talk about more than a hundred years later? One. We think [our work] doesn't reduce Munch's greatness; it enhances it."

Olson now is working on an analysis of the skies in three other Munch paintings. After that, Claude Monet's *Impression, Sunrise*. In the 1970s, John Rewald, an Impressionist scholar, asked whether the painting's sunrise might actually be a sunset. Tucker tried his hand at the problem in 1984, consulting period maps and photographs of Le Havre, where Monet painted the piece, and concluded that the artist had indeed captured a sunrise. But, he said, "I would be more than happy to be corrected, and if [Olson] were able to bring scientific [and] astronomical issues to bear, all the better."

Whatever his findings, Olson's forays into art and literature are likely to keep stirring the debate about the sources of great art. His work may not change the way we see Munch or Adams or Chaucer, but it does tell us at least a bit about their three-dimensional worlds. And from there, we can see where the true genius begins.

Sunup? Or down? Olson has been collecting vintage postcards of Le Havre for a study of Monet's *Impression, Sunrise*.

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GRANGER COLLECTION, NEW YORK; MUSEE MARMOTTAN-CLAUDE MONET, PARIS / ART RESOURCE, NY

Joshua Tewksbury (in Bolivia's Amboró National Park) says this wild variety with tiny fruits may hold a key to chilies' most salient property.

WHAT'S SO HOT ABOUT CHILI PEPPERS?

A GONZO BOTANIST BRAVES THE BACK ROADS OF WILD BOLIVIA TO FIND THE ROOTS OF THE WORLD'S MOST PIQUANT SPICE

TEXT AND PHOTOGRAPHS BY BRENDAN BORRELL

SEATED IN THE BED OF A PICKUP TRUCK, JOSHUA TEWKSBURY cringes with every curve and pothole as we bounce along the edge of Amboró National Park in central Bolivia. After 2,000 miles on some of the worst roads in South America, the truck's suspension is failing. In the past hour, two leaf springs—metal bands that prevent the axle from crashing into the wheel well—jangled onto the road behind us. At any moment, Tewksbury's extraordinary hunting expedition could come to an abrupt end.

A wiry 40-year-old ecologist at the University of Washington, Tewksbury is risking his sacroiliac in this fly-infested forest looking for a wild chili with a juicy red berry and a tiny flower: *Capsicum minutiflorum*. He hopes it'll help answer the hottest question in botany: Why are chilies spicy?

Bolivia is believed to be the chili's motherland, home to dozens of wild species that may be the ancestors of all the world's chili varieties—from the mild bell pepper to the medium jalapeño to the rough-skinned naga jolokia, the hottest pepper ever tested. The heat-generating compound in chilies, capsaicin, has long been known to affect taste buds, nerve cells and nasal membranes (it puts the sting in pepper spray). But its function in wild chili plants has been mysterious.

Which is why Tewksbury and his colleagues have made multiple trips to Bolivia over the past four years. They're most interested in mild

chilies, especially those growing near hot ones of the same species—the idea being that a wild chili lacking capsaicin might serve as a kind of exception that proves the rule, betraying the secret purpose of this curiously beloved spice.

Bounding along in the truck, we reach a cluster of houses next to a river. Somewhere near this spot a few years ago, Michael Nee of the New York Botanical Garden collected a *C. minutiflorum* specimen, and Tewksbury wants to sample its relatives. In his notes, Nee wrote that the fruit he tasted was sweet. But Tewksbury just encountered the same species several hundred miles away and tasted it himself. That one was spicy, and the discrepancy was worth investigating.

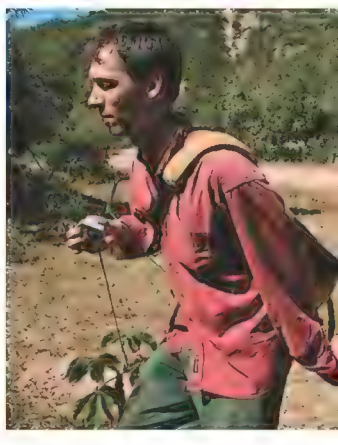
Tewksbury pops a wad of coca leaves—the source of cocaine and Bolivia's answer to espresso—into his mouth and steps smiling into the drizzling rain. A middle-aged man appears outside a low-slung house, his tan shirt open to his belt. Tewksbury says one benefit of his research is he doesn't have to look too hard for his subject. He just asks the local residents, tossing out a few Bolivian names for wild chilies: Any *ulupica*? Any *arivivi*?

The man shakes his head at the crazy gringo. Here? No. Up the mountain. Tewksbury is puzzled. "Are there any peppers without the spice?" he asks in broken Spanish. No, the man says. Tewksbury shrugs and crosses the highway to another yard, where a woman stands with a mop. She, too, says he must be mistaken. There's no ulupica here.

DAZED, HE PLUCKS A FRUIT AND BITES INTO IT. HE SPITS IT OUT AND GRIMACES—THIS ONE IS HOT. HE COULDN'T BE HAPPIER.

The other four people in our group linger at the vehicle. We're wet. Biting flies leave red welts on our necks and arms. Noelle Machnicki, a University of Washington graduate student, has a plane to catch. Tewksbury marches down the road, hops over a strand of barbed wire, and lumbers up a slope through a tangle of moist weeds. The others make halfhearted efforts to scan the area around the truck, while I follow Tewksbury up the hill. As he enters the forest, marble-size red globes catch his eye: *C. minutiflorum*. Tewksbury bites into a fruit. "Not pungent," he says, slipping a few into an envelope.

He walks over to another plant. It, too, is sweet. Soon he has tasted fruits from eight plants and not one is spicy. This could well be an entirely mild wild chili population—the first ever—he muses, then erupts into a frenzy of free association, cooking up evolutionary trees for the strange chilies. Suddenly, a monkey in the canopy above us leaps from one branch to the next, and rainwater cascades onto our heads. Tewksbury watches the animal's acrobatics before performing some of his own: a vine snags his ankle and he tumbles face first into a chili bush, another *C. minutiflorum*. Dazed, he plucks a fruit and bites into it. He spits it out and grimaces—this one is hot. He couldn't be happier.



PEOPLE HAVE BEEN SPICING UP their food with chilies for at least 8,000 years. At first they used wild chilies, likely adding them to potatoes, grain and corn, says Linda Perry, an archaeobotanist at Smithsonian's National Museum of Natural History. She has found traces of chilies on ancient milling stones and cooking pots from the Bahamas to southern Peru. Based on her studies of potsherds from different archaeological sites, she concludes that people in the Americas began cultivating chilies more than 6,000 years ago. Just why they did is a matter of scholarly debate. Perry believes it was a question of taste. "Chilies were domesticated early and spread very quickly just because people like them," she says. "Do you want a big pot of yams or a pot of yams with chilies thrown in?" Other researchers, such as Jennifer Billing and Paul Sherman at Cornell University, argue that people learned early on that chilies could reduce food spoilage. And some scholars point to medical uses. Ancient Mayans in-

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more valuable than the common sort [black pepper]," he later wrote. "They deem it very wholesome and eat nothing without it." Columbus took chilies back to Spain, but they initially were unappreciated in Europe. The Portuguese got acquainted with chilies at their trading post in Pernambuco, Brazil, and carried them, with tobacco and cotton, to Africa. Within 50 years of Columbus' voyages, Pernambuco chilies were being cultivated in India, Japan and China. Chilies made it to the American Colonies with the English in 1621.

In the United States, where chilies were once an exotic spice, consumption increased by 38 percent between 1995 and 2005. The rise reflects both the influx of immigrants from countries where spicy food is common and more adventurous eating among the general population. According to the U.S. Department of Agriculture, the average American now consumes 5.9 pounds of chilies a year, more than the per capita consumption of asparagus, cauliflower or green peas.

When people call chilies "hot," they're not just speaking metaphorically. Capsaicin stimulates the neural sensors in the tongue and skin that also detect rising temperatures. As far as these neurons and the brain are concerned, your mouth is on fire. (Similarly, mint stimulates a type of neural receptor sensitive to cool temperatures.) With enough heat, adrenaline flows and the heart pumps faster. This reaction, according to some physiologists, is part of what makes peppers so enticing.

"Every valley we go into has a different chili," says Tewksbury (above: in white, with Carlos Manchego in red, interviewing a man in rural Bolivia). Below, from left: Tewksbury keeps trucking; plots a census with Noelle Machnicki; and looks for bug bites.

corporated chilies into medicinal preparations for treating infected wounds, gastrointestinal problems and earaches. Laboratory studies have shown that chili pepper extracts inhibit a number of microbial pathogens, and capsaicin has been used in a local anesthetic.

Whatever the benefits, chilies spread around the world with astonishing speed, thanks in part to Christopher Columbus. In 1492, the explorer encountered some plants cultivated by the Arawak Indians in Hispaniola. Convinced he had landed in India, he referred to them as "pepper," an unrelated spice native to the subcontinent. "The land was found to produce much *ají*, which is the pepper of the inhabitants, and

The scale that scientists use to describe a chili's heat was developed in 1912 by Wilbur Scoville, a chemist at Parke-Davis pharmaceutical company in Detroit. He would dilute a pepper extract in sugar water until the heat was no longer detectable by a panel of trained tasters; that threshold is its Scoville rating. A bell pepper, for instance, merits a zero, while a typical jalapeño falls between 2,500 and 8,000 Scoville heat units (SHUs). Last year, the naga jolokia, which is cultivated in India, rated a whopping one million SHUs. What's remarkable is that this variation can occur within a single species. The cayenne pepper, *C. annuum*—50,000 SHUs—is the species from which countless domesticated varieties of bell peppers, jalapeños and poblanos were derived.

Tewksbury first studied chilies near the Tumacácori mission in the mountains of southern Arizona—home to the world's northernmost wild variety, chiltepins. The Rev. Ignaz Pfefferkorn had developed a liking for chiltepins there in the 1750s. Pfefferkorn (whose name means "peppercorn" in German) called them "hell-fire in my mouth." In 1999, Tewksbury and Gary Nabhan, who co-founded Native Seeds/Search, an organization that works to preserve

BRENDAN BORRELL *wrote about cassowaries in the October, 2008 issue of* SMITHSONIAN. *He lives in Brooklyn, New York.*

MAP: GUILBERT GATES

"I had no idea what I was getting into when I said, 'Okay, I'll go to Bolivia with Josh,'" says Machnicki (left: with chili seedlings). Tewksbury (right: taste-testing) and colleagues study whether the hot stuff in chili fruit deters bugs that may carry fungus.

indigenous agricultural plants of the Southwest, established the Wild Chile Botanical Area in Tumacácori. That's when Tewksbury started wondering why chilies were hot.

CHILIES, LIKE OTHER FRUITS, lure birds and other animals to eat them and disperse their seeds. But chilies also attract seed predators, like rodents, that crush seeds and make germination impossible. Many plants produce toxic or foul-tasting chemicals that deter seed predators, but these chemicals are usually found in the plant's leaves and roots as well as its fruit. In chilies, however, capsaicin is found only in the fruit—secreted via a special gland near the stem—and its production increases dramatically as the fruit ripens. Tewksbury and Nabhan suspected that capsaicin protects chilies from rodents.

To test the theory, Tewksbury wanted to compare spicy and mild chilies from the same species, if only he could find some. He contacted Paul Bosland, of the Chile Pepper Institute at New Mexico State University, who maintains a huge collection of chili seeds. Bosland told Tewksbury that he had tasted an unusual chili in his greenhouse one day in 1996. "I took a bite of it just to see what it tasted like and I said 'hmm' that fruit doesn't seem to have any heat," he recalls. "So, I took another one and I said 'hmm' that one doesn't either." The chili had come from seeds collected in Bolivia 37 years earlier. Bosland took note of it, wrote it off as a mutant and placed the seeds back in the freezer. But after Tewksbury called, he pulled them out again.

Tewksbury used the seeds to grow chiles for his experiments. When he offered the fruits of those labors to laboratory packrats and cactus mice, the rodents ate the mild chilies but avoided the hot ones. Such studies convinced him "that capsaicin is all about parental care," Tewksbury says. "It's all about plants caring for their offspring," the fruits. He later found that capsaicin also has the strange effect of slowing birds' digestive systems, which helps some seeds germinate, possibly by softening the seed coat. (Birds don't mind eating capsaicin; in fact, some backyard birdwatchers spike their birdseed with chili powder to stop squirrels from raiding feeders.) Even so, Tewksbury didn't believe that deterring rodents and slowing bird digestion were enough to explain why spiciness evolved in the first place. Instead, he has come to think that a chili's heat protects it from much smaller foes.

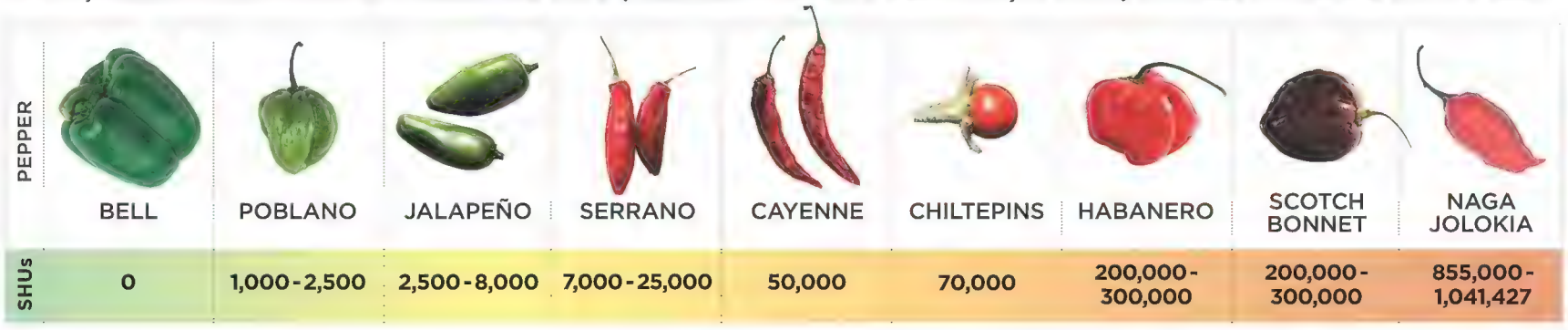
In Bolivia, fungal rot is a more pervasive threat than rodents. More than 90 percent of ripe wild chili fruits contain signs of fungal infection; it is the primary reason seeds die prior to being dispersed. Back in the lab in Seattle, Machnicki has found that just one fungus—from the *Fusarium* genus, light pink in color—is the main culprit regardless of the chili species. "It's not a random fungus," says Machnicki. "It's strongly associated with these chili peppers."

In looking at pepper populations that contain both spicy and mild plants, Tewksbury and Machnicki have found that the more capsaicin, the less fungal infection. Furthermore, the fungus thrives in humid environments, and Tewksbury and colleagues have found that chilies in Bolivia seem to adjust accordingly: the moister the climate, the spicier the chilies. In the lab, fungus raised from mild peppers is easily inhibited by a little spiciness, whereas fungus from spicier pepper populations can withstand more heat.

"Capsaicin demonstrates the incredible elegance of evolution," says Tewksbury. The specialized chemical deters microbes—humans harness this ability when they use

HOW HOT IS IT?

In 1912, chemist Wilbur Scoville invented the scale (measured in Scoville Heat Units, or SHUs) still used to indicate a chili's heat.



ABOVE CENTER: TOMAS CARLO; BELOW: AGE FOTOSTOCK (2); PHOTOLIBRARY; AGE FOTOSTOCK; PHOTOLIBRARY; TOMAS CARLO; AGE FOTOSTOCK (2); GANNON ANJO / WIKIPEDIA COMMONS

People have been eating chilies (a market in Cochabamba, Bolivia) for at least 8,000 years and cultivating the plants for 6,000.

TOMAS CARLO

chilies to preserve food—but capsaicin doesn't deter birds from eating chili fruits and spreading seeds. "Once in a while, the complex, often conflicting demands that natural selection places on complex traits results in a truly elegant solution. This is one of those times."

William Foley, a nutritional ecologist at the Australian National University in Canberra, says Tewksbury is "working on the right system to answer tricky ecological questions people have been asking for a long time." Denise Dearing, an ecologist at the University of Utah, calls Tewksbury's research "the most in-depth work on a plant-frugivore [fruit eater] interaction." Tewksbury's success comes in part from his fearless exploration of the chili's motherland. Adds Foley: "You can't expect to understand complex interactions be-

tween plants and animals unless you're actually in the field."

IT TAKES A SPECIAL KIND of perseverance to conduct fieldwork in the Gran Chaco, a dry forest wilderness that covers 500,000 square miles in Paraguay, Argentina, Brazil and Bolivia. In Bolivia, only 6 percent of the roads are paved and gasoline and accurate maps are hard to come by. Weather fluctuates between oppressive heat and torrential rain—turning roads into mud wallows. The researchers' truck is outfitted with two spare tires, but it was once stopped by a third flat. In the course of their research, the scientists have lost a wheel (loose lug nuts), snapped an axle (inexperienced driver) and cracked the engine block (river crossing). Their sponsoring organization, the Fundación Amigos de la Naturaleza, had to replace the entire vehicle when it was stolen in 2003.

Tewksbury says his fieldwork runs on three compounds: coca, caffeine and capsaicin. But his fascination with natural products and his seeming indefatigability may have deeper roots. His father, Peter Tewksbury, was the director of the 1950s TV sitcoms "My Three Sons" and "Father Knows Best" and the short-lived but acclaimed series "It's a Man's World," which featured Josh's mother, Cielle, acting under the name Ann Schuyler. Peter would eventually direct Elvis Presley in *Stay Away, Joe* and *The Trouble With Girls* and worked briefly with

"CAPSAICIN DEMONSTRATES THE INCREDIBLE ELEGANCE OF EVOLUTION," SAYS TEWKSBURY. "IT IS ALL ABOUT PARENTAL CARE."

J. D. Salinger in a failed attempt to bring one of his short stories to the screen. Eventually fed up with the constraints of Hollywood, Peter came home one day in the 1970s, pulled his Emmy Award from the closet and chucked it into the trash can. "It was one of his bitter moments," Cielle recalls. "He had an incredible sense of morality and ethics, and it just didn't match with a Hollywood career." As Peter himself would later tell the *New York Times*, "Peter Tewksbury the director is dead."

The couple packed up the car and drove with their two children to Vermont, where they adopted the names Henry and Mary Jane. "Henry" became a renowned cheese expert and the author of *The Cheeses of Vermont: A Gourmet Guide to Vermont's Artisanal Cheesemakers*. They home-schooled Josh and his sister, Marintha, and moved among Vermont, Quebec, Oregon and a ranch in California. Peter Tewksbury died in 2003 at age 79. "When [Peter] would glom onto something he wanted to do, it was just [at] a dead run," says Cielle, 71, who teaches the Taoist philosophy tai chi and Chinese sword and saber techniques in Brattleboro, Vermont. "There's quite a bit of him in Josh: the excitement, the drive and the complete dedication and focus."

Indeed, some mornings in Bolivia, Josh Tewksbury was in such a rush to get out to the field that he'd put his shirt on inside out or backward. Talking about science, he would get a faraway look and say, "that would be slick." From the back of the truck one day, he yelled to colleagues riding in the cab about a new experiment he was contemplating. Carlos Manchego, a student at Bolivia's Natural History Museum, and Tomás Carlo, an ecologist at Pennsylvania State University, spent the next hour hashing it out with Tewksbury as they hung out the windows, clutching the roof rack.

His zeal can sometimes get the better of him. About eight years ago, he and Doug Levey of the University of Florida, an expert on plant and animal interactions, were visiting Ilha do Cardoso off the coast of Brazil. The duo became convinced they had uncovered a novelty: a fungus whose spores were dispersed by a bird. They spent several days frantically collecting samples with hopes of culturing the fungus back in the lab. They hoped to submit their findings to a prestigious journal. But when they finally examined the "fungus" under a microscope, they noticed it had legs—and there's nothing unusual about birds eating insects.

But Levey points out that even Tewksbury's misguided enthusiasms may prove fruitful: "There's a long history in science of the most important discoveries being made by accident or by following a whim."

"I THINK THIS IS INSANE right now," says Machnicki as she plucks a huge spine out of the back of her knee. Her nylon quick-dry pants are no match for the Bolivian forest. At her feet, a snake-like cactus winds among thickets of spiny ground bromeliads ("my nemesis," she calls them), thorny shrubs and the bulbous stem of the devil nettle.

"Hey, I can't find my field notebook," Tewksbury calls out to colleagues after seeing a chili plant in a thicket of acacia thorns and cactus. Despite his sometimes seat-of-the-pants science, he has managed to figure out how capsaicin benefits chili plants.

We had camped the night before on a low plateau overlooking the Paraguayan border. Our breakfast—and the last of our food supplies—consisted of a thimbleful of cold coffee, a boxed juice drink and a modest bag of trail mix. Instead of moving on as planned, Tewksbury's wandering legs took him to an unexpected patch of chilies. He was soon stringing a measuring tape through the woods to count every one of them in a plot some 200 yards on each side. After two years of laboratory work, Machnicki, a fungus expert, is finally getting a chance to see the natural habitat where her seed-killing fungus thrives. At the moment, though, she would rather be eating lunch. "Everything with him is by the seat of your pants," she would tell me later.

After Tewksbury paces off the census plot, the team spreads out and begins scouting chilies. Carlo points a laser rangefinder at Tewksbury, who is hovering over a chili plant, so that Carlo can add the plant to a map he's drawing. Tewksbury counts fruits, both ripe and unripe, and assesses their pungency, which is a bit like playing Russian roulette. "I think it's going to hurt," the human capsaicin meter says as he pops a fruit in his mouth. "Ah!" he yelps. (They will test samples more rigorously back in the lab in Seattle.)

Tewksbury scans the plants for fruit-sucking bugs, using his own nicknames. "Red-shouldered beetle mimic," Tewksbury yells, referring to a true bug (order Hemiptera) he once thought was a beetle (order Coleoptera) until an entomologist set him straight. "One, two, three—oh—and red butts!" he says, noticing another insect species that hangs out on the underside of the chili leaves.

During a previous expedition, Levey realized that such bugs may be spreading the seed-killing fungus from chili plant to chili plant. While the rest of the team was out sampling chilies, Levey was stuck in camp, recovering from a bout of intestinal distress. As a distraction, he says, he spent a lot of time examining chilies with a magnifying glass, "and I discovered that a lot of them were pitted with holes from these bugs. When I opened them, I could see traces of fungal infection on the seeds themselves." This fungus was either hitchhiking from fruit to fruit on the proboscis of these bugs, or else the bugs' piercings were simply making it easier for the fungus to infiltrate the flesh.

In any event, the critical test of the theory that capsaicin is an adaptation to fight fungus would come from growing pungent and nonpungent chilies next to each other in the wild to find out if one type does better than the other. Last field season, Tewksbury had hired a man named Don Odon to tend a thousand chili plants at his remote ranch in preparation for the test. But only three plants survived. The rest may have fallen victim to Don Odon's enthusiastic watering regime. If Tewksbury was discouraged when we visited the ranch, he didn't show it.

As we traced our zigzag path southward, he found a huge crop of young wild plants with mild chilies in the town of Yuqueriti. Then we drove on for hours. But when the team woke up the next morning in Charagua, Tewksbury had a "slick" idea. We could race back to Yuqueriti, dig up the mild chili seedlings and haul them several hundred miles to a ranch in the Andean foothills where the plants are all spicy, to learn which are hardier. Tewksbury's enthusiasm can be hard to argue with, and six hours later I would find myself bouncing along in the back of the truck, trying to keep myself and 89 uprooted chili plants from being crushed under a pile of luggage.

Two days later, when we arrive at the ranch in the foothills, Tewksbury observes that the native chili peppers have been "hammered" by drought and cattle grazing. He doesn't think his experimental seedlings would survive in these conditions. He finds another ranch where the owner will allow the team to plant the seedlings on the edge of a cornfield. For a small fee, the owner agrees to tend them. Tewksbury is in high spirits as the team plants each mild chili next to a wild spicy one. When the plants begin fruiting next year, they'll see how many fruits survive and how much fungus they have. Ideally, the team would also dig up spicy plants in the foothills and transplant them near mild plants in Yuqueriti. But this is seat-of-your-pants science, and Tewksbury will have to wait a year to get a more substantial experiment going. "I hope to be working on this system for another 10 to 20 years," he says as he pats soil around the last chili plant. "I can't see myself running out of questions in less than that."

Find recipes with chilies at Smithsonian.com/chilies

The Writer's Eye

The photographs of Eudora Welty, born 100 years ago this month, hint at the sensibility that would mark her as a storyteller

BY T. A. FRAIL

EUDORA WELTY was one of the grandest grande dames of American letters—winner of a Pulitzer Prize, the National Book Critics Circle Award, an armful of O. Henry Awards and the Medal of Freedom, to name just a few. But before she published a single one of her many short stories, she had a one-woman show of her photographs.

The pictures, made in Mississippi in the early to mid-1930s, show the rural poor and convey the want and worry of the Great Depression. But more than that, they show the photographer's wide-ranging curiosity and unstinting empathy—which would mark her work as a writer, too. Appropriately, another exhibition of Welty's photographs, which opened last fall at the Museum of the City of New York and travels to Jackson, Mississippi, this month, inaugurated a yearlong celebration of the writer's birth, April 13, 1909.

"While I was very well positioned for taking these pictures, I was rather oddly equipped for doing it," she would later write. "I came from a stable, sheltered, relatively happy home that by the time of the Depression and the early death of my father (which happened to us in the same year) had become comfortably enough off by small-town Southern standards."

Welty (above: 1939) first learned to use a camera as a teenager. Later, after a year in graduate school in New York City, she returned to her native Mississippi and began taking pictures (right: *Home by Dark*).

Her father died of leukemia in 1931, at age 52. And while the comfort of the Welty home did not entirely unravel—as an insurance executive in Jackson, Christian Welty had known about anticipating calamities—Eudora was already moving beyond the confines of her family environment.

She had graduated from the University of Wisconsin and studied business for a year at Columbia University. (Her parents, who entertained her stated ambition of becoming a writer, insisted that she pursue the proverbial something to fall back on.) She returned to Jackson after her father's diagnosis, and after he died, she remained there with her mother,

She recalled moving "through the scene openly and yet invisibly because I was part of it, born into it, taken for granted."

Despite her relatively privileged Southern upbringing, Welty was notably attentive to the lives and plight of African-Americans (right: *Sunday Morning*) and laborers (above: *Tomato Packers, Recess*).

writing short stories and casting about for work.

For the next five years, Welty took a series of part-time jobs, producing a newsletter at a local radio station; writing for the *Jackson State Tribune*; sending society notes to the Memphis *Commercial Appeal*; and taking pictures for the Jackson Junior Auxiliary. She had used a camera since adolescence—her father, an avid snapshot man, helped establish Jackson's first camera store—but now she began taking photography more seriously, especially as she traveled outside Jackson. In 1934, she applied to study at the New School for Social Research in New York City with photographer Berenice Abbott, who was documenting landmarks disappearing in the city's rush toward modernity. Welty's application was turned down.

It hardly mattered. Through the early '30s, Welty gathered a body of work remarkable for the photographer's choice of subjects and her ability to put them—or keep them—at ease. That is especially noteworthy given that many of her subjects were African-Americans. "While white people in a Deep South state like Mississippi were surrounded by blacks at the time . . . they were socially invisible," the television journalist and author Robert MacNeil, a longtime friend of Welty's, said in an interview during a recent symposium on her work at the Museum of the City of New York. "In a way, these two decades before the civil rights movement began, these photographs of black people give us insight into a personality who saw the humanity of these people before we began officially to recognize them."

Welty, for her part, would acknowledge that she moved "through the scene openly and yet invisibly because I was part of it, born into it, taken for granted," but laid claim only to a personal agenda. "I was taking photographs of human beings because they were real life and they were there in front of me and that was the reality," she said in a 1989 interview. "I was the recorder of it. I wasn't trying to exhort the public"—in contrast, she noted, to Walker Evans and other American documentary photographers of the '30s. (When a collection of her pictures was published as *One Time, One Place* in 1971, she wrote: "This book is offered, I should explain,

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T. A. FRAIL *is a senior editor of the magazine.*

"I learned that every feeling waits upon its gesture; and I had to be prepared to recognize this moment when I saw it."

The privations of the Depression were a recurring subject (above: *Underwear,* now better known as *Window Shopping*)—as were patterns in the New York City streetscape (right: *Untitled*).

not as a social document but as a family album—which is something both less and more, but unadorned.")

In early 1936, Welty took one of her occasional trips to New York City. This time she brought some photographs in the hope of selling them. In a decision biographer Suzanne Marrs describes as spontaneous, Welty dropped in at the Photographic Galleries run by Lugene Opticians Inc.—and was given a two-week show. (That show has been recreated for the centennial exhibit and supplemented with pictures she made in New York.)

That March, however, Welty received word that a small magazine called *Manuscript* would publish two short stories she had submitted. "I didn't care a hoot that they couldn't, they didn't pay me anything," she would recall. "If they had paid me a million dollars it wouldn't have made any difference. I wanted acceptance and publication."

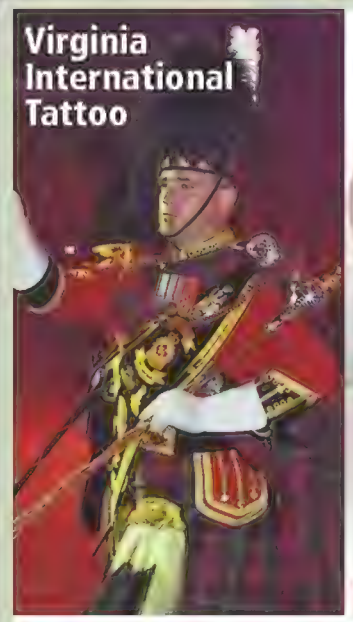
That acceptance foretold the end of her photographic career. Welty used her camera for several years more but invested her creative energies in her writing. "I always tried to get her to start over again, you know, when I got to know her in the mid-1950s," the novelist Reynolds Price, another longtime friend of Welty's, said in an interview. "But she'd finished. She said, I've done what I have to do. I've said what I had to say."

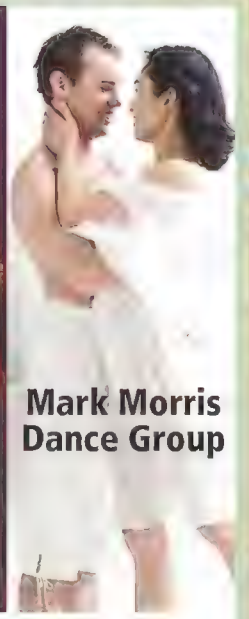
In her memoir, *One Writer's Beginnings*, published in 1984, Welty paid respects to picture-taking by noting: "I learned in the doing how ready I had to be. Life doesn't hold still. A good snapshot stopped a moment from running away. Photography taught me that to be able to capture transience, by being ready to click the shutter at the crucial moment, was the greatest need I had. Making pictures of people in all sorts of situations, I learned that every feeling waits upon its gesture; and I had to be prepared to recognize this moment when I saw it."

She added: "These were things a story writer needed to know. And I felt the need to hold transient life in words—there's so much more of life that only words can convey—strongly enough to last me as long as I lived."

That was long indeed. Welty died on July 23, 2001, at the age of 92. Her literary legacy—not only her stories but her novels, essays and reviews—traces the full arc of a writer's imagination. But the pictures bring us back to the time and the place it all began.

For more on Eudora Welty, visit smithsonian.com/welty





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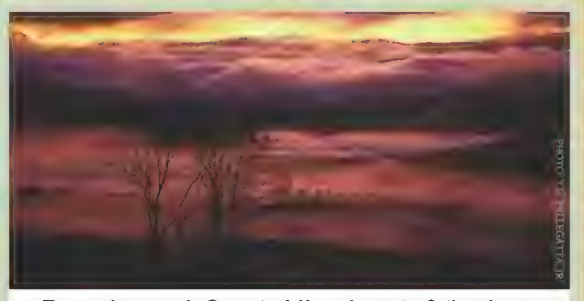

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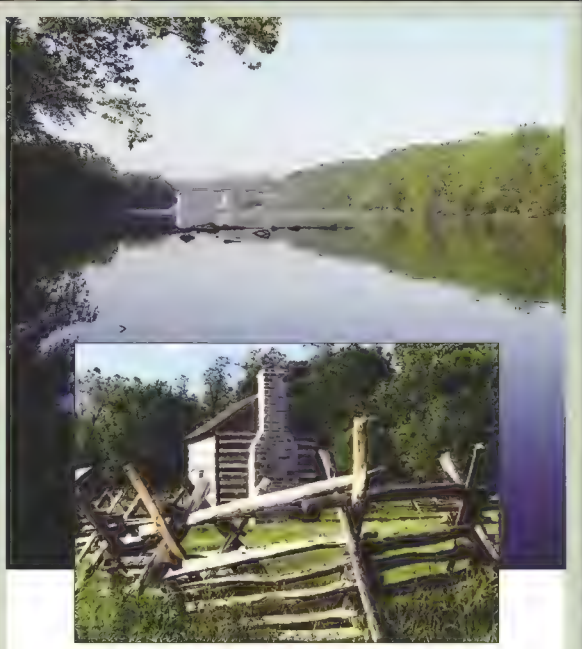

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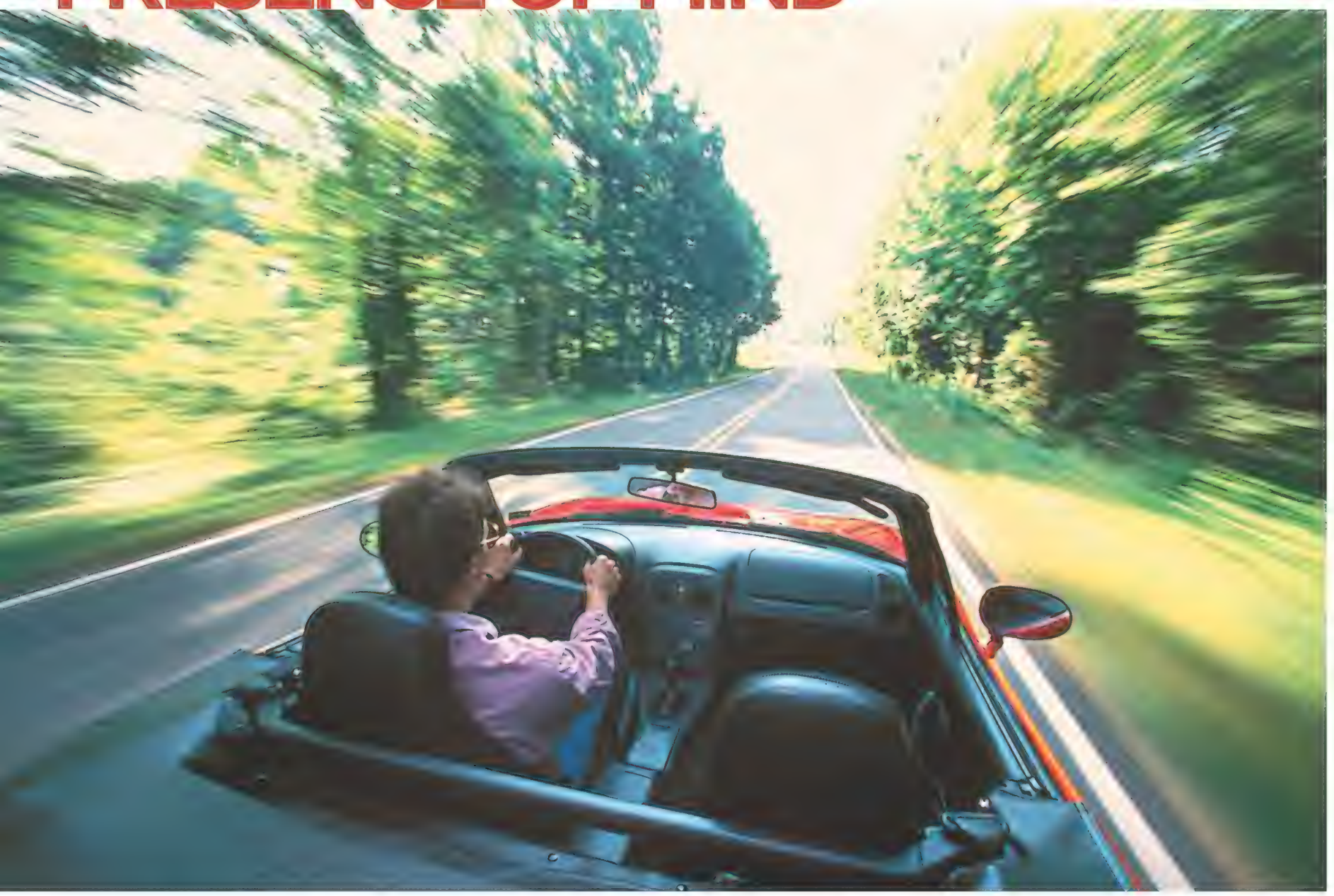

Buckle Up. And Behave

The three-point seat belt turns 50—and still has much to teach us about risk and recklessness

BY WILLIAM ECENBARGER

IN THE MIDDLE of the last century, Volvo began seeking improvements to seat belts to protect drivers and passengers in its vehicles. When the Swedish automaker tried a single strap over the belly, the result was abdominal injuries in high-speed crashes. The engineers also experimented with a diagonal chest restraint. It decapitated crash-test dummies.

Volvo then turned to a 38-year-old mechanical engineer named Nils Bohlin, who had developed pilot ejector seats for the Saab aircraft company. Bohlin knew it would not be easy to transfer aerospace technology to the automobile. "The pilots I worked with in the aerospace industry were willing to put on almost anything to keep them safe in case of a crash," he told an interviewer shortly before he died, in 2002, "but regular people in cars don't want to be uncomfortable even for a minute."

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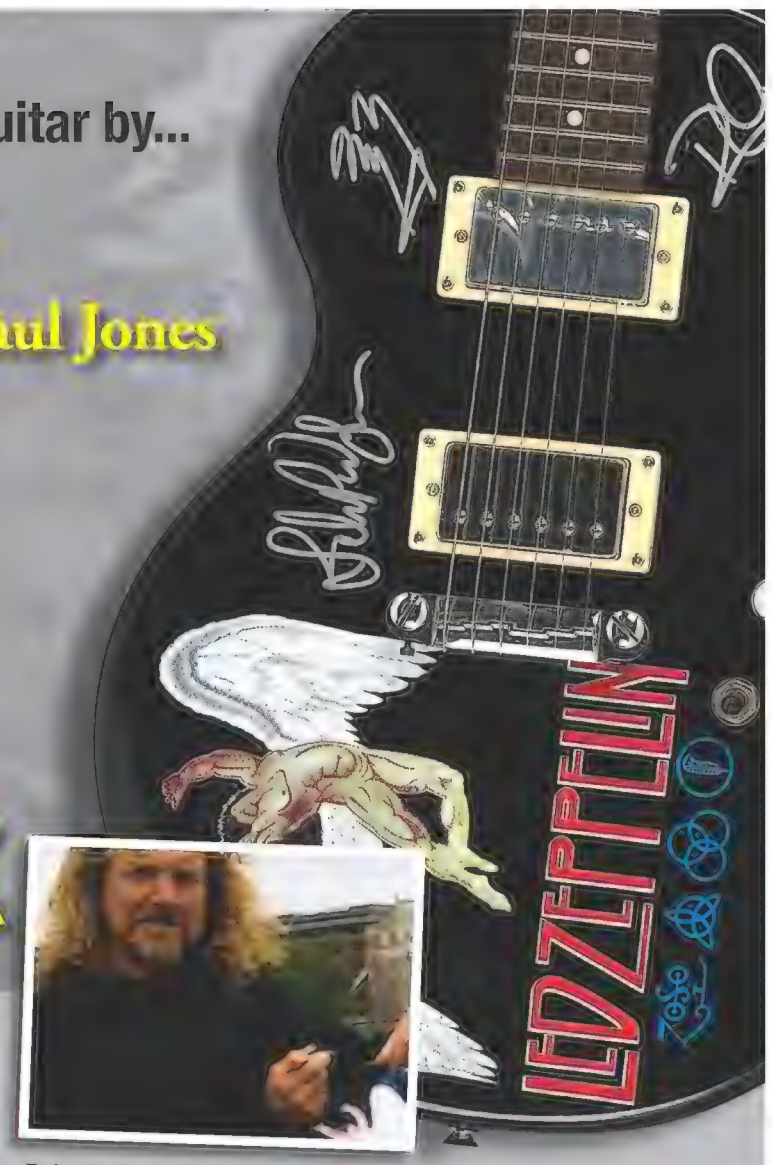

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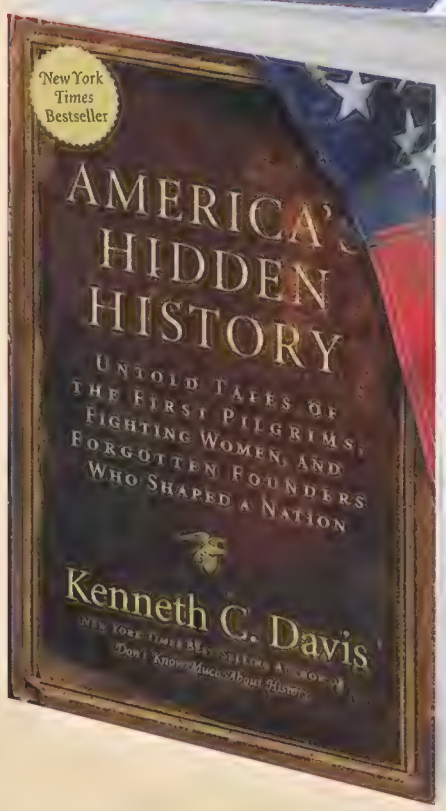
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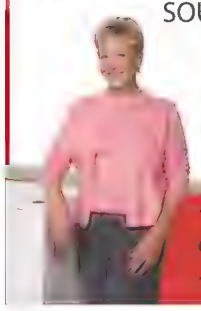

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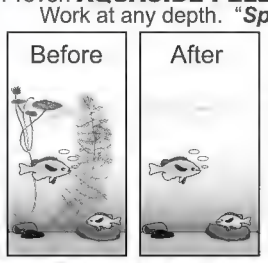

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The idea is that humans have an inborn tolerance for risk—meaning that as people are made to feel less vulnerable, they tend to take more chances. The feeling of greater security tempts us.

Nils Bohlin (1959): developing the auto seat belt was a bit like rocket science.

This counterintuitive idea was introduced in academic circles several years ago and is broadly accepted today. The concept is that humans have an inborn tolerance for risk—meaning that as safety features are added to vehicles and roads, drivers feel less vulnerable and tend to take more chances. The feeling of greater security tempts us to be more reckless. Behavioral scientists call it "risk compensation."

The principle was observed long before it was named. Soon after the first gasoline-powered horseless carriages appeared on English roadways, the sec-

VOLVO CAR CORPORATION

retary of the national Motor Union of Great Britain and Ireland suggested that all those who owned property along the kingdom's roadways trim their hedges to make it easier for drivers to see. In response, a retired army colonel named Willoughby Verner fired off a letter to the editor of the *Times* of London, which printed it on July 13, 1908.

"Before any of your readers may be induced to cut their hedges as suggested by the secretary of the Motor Union they may like to know my experience of having done so," Verner wrote. "Four years ago I cut down the hedges and shrubs to a height of 4ft for 30 yards back from the dangerous crossing in this hamlet. The results were twofold: the following summer my garden was smothered with dust caused by fast-driven cars, and the average pace of the passing cars was considerably increased. This was bad enough, but when the culprits secured by the police pleaded that 'it was perfectly safe to go fast' because 'they could see well at the corner,' I realised that I had made a mistake." He added that he had since let his hedges and shrubs grow back.

Despite the colonel's prescience, risk compensation went largely unstudied until 1975, when Sam Peltzman, a University of Chicago economist, published an analysis of federal auto-safety standards imposed in the late 1960s. Peltzman concluded that while the standards had saved the lives of some vehicle occupants, they had also led to the deaths of pedestrians, cyclists and other non-occupants. John Adams of University College London studied the impact of seat belts and reached a similar conclusion, which he published in 1981: there was no overall decrease in highway fatalities.

There has been a lively debate over risk compensation ever since, but today the issue is not whether it exists, but the degree to which it does. The phenomenon has been observed well beyond the highway—in the workplace, on the playing field, at home, in the air. Researchers have found that improved parachute rip cords did not

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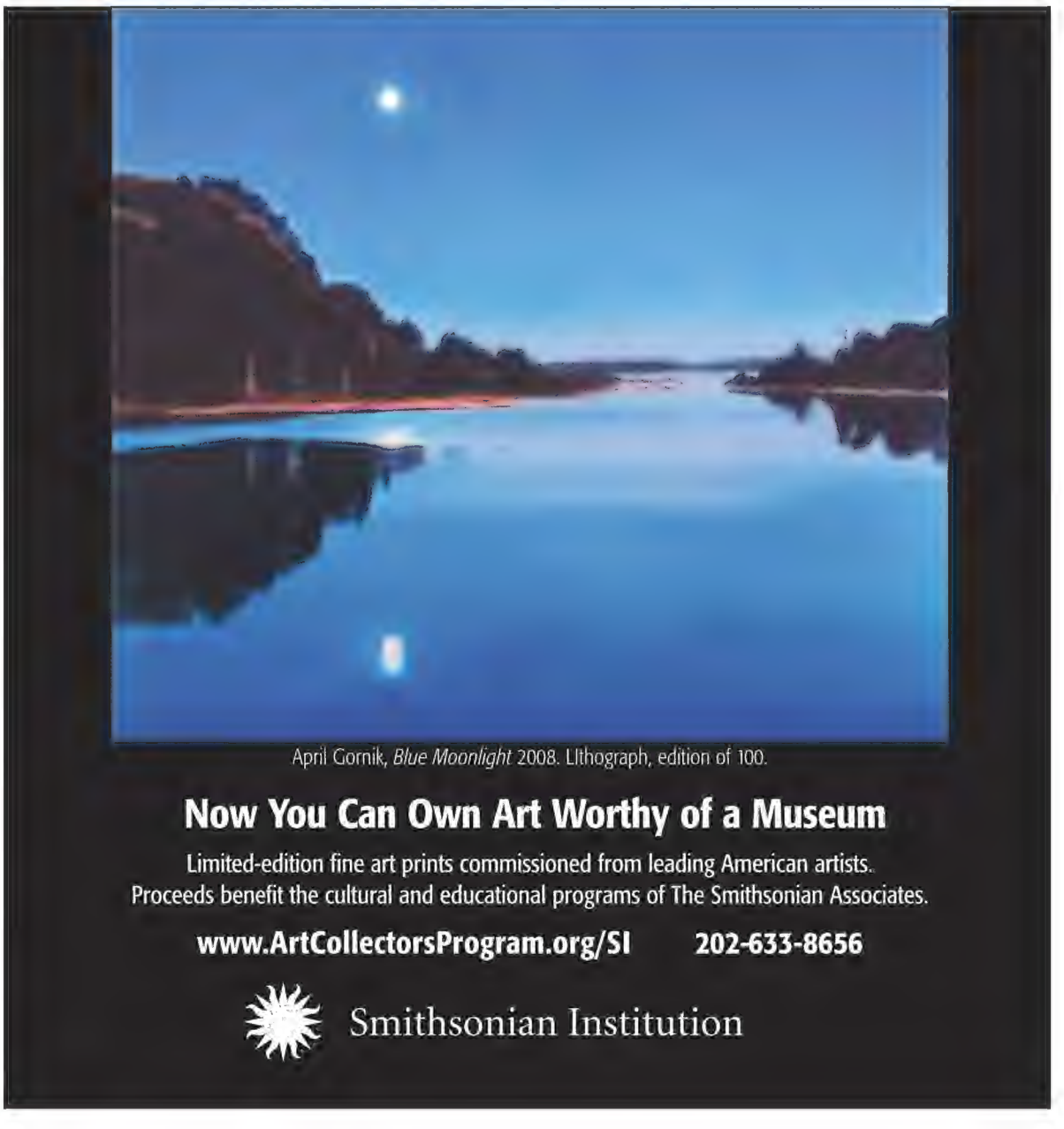
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Two hundred economists petitioned Congress not to pass the $700 billion bank bailout plan in order to preserve some balance between risk, reward and responsibility.

Bankers testify before a U.S. House financial committee in February 2009.

reduce the number of sky-diving accidents; overconfident sky divers hit the silk too late. The number of flooding deaths in the United States has hardly changed in 100 years despite the construction of stronger levees in flood plains; people moved onto the flood plains, in part because of subsidized flood insurance and federal disaster relief. Studies suggest that workers who wear back-support belts try to lift heavier loads and that children who wear protective sports equipment engage in rougher play. Forest rangers say wilderness hikers take greater risks if they know that a trained rescue squad is on call. Public health officials cite evidence that enhanced HIV treatment can lead to riskier sexual behavior.

All of capitalism runs on risk, of

MANUEL BALCE CENETA / AP IMAGES

course, and it may be in this arena that risk compensation has manifested itself most calamitously of late. William D. Cohan, author of *House of Cards*, a book about the fall of Bear Stearns, speaks for many when he observes that "Wall Street bankers took the risks they did because they got paid millions to do so and because they knew there would be few negative consequences for them personally if things failed to work out. In other words, the benefit of their risk-taking was all theirs and the consequences of their risk-taking would fall on the bank's shareholders." (Meanwhile investors, as James Surowiecki noted in a recent *New Yorker* column, tend to underestimate their chances of losing their shirts.) Late last year, 200 economists—including Sam Peltzman, who is now professor emeritus at Chicago—petitioned Congress not to pass its $700 billion plan to rescue the nation's overextended banking system in order to preserve some balance between risk, reward and responsibility. Around the same time, columnist George Will pushed the leaders of the Big Three automakers into the same risk pool.

"Suppose that in 1979 the government had not engineered the first bailout of Chrysler," Will wrote. "Might there have been a more sober approach to risk throughout corporate America?"

Now researchers are positing a risk compensation corollary: humans don't merely tolerate risk, they seek it; each of us has an innate tolerance level of risk, and in any given situation we will act to reduce—or increase—the perceived risk, depending on that level.

The author and principal proponent of this idea is Gerald J.S. Wilde, professor emeritus of psychology at Queen's University in Kingston, Ontario. In naming his theory "risk homeostasis," Wilde borrowed the word used for the way we humans, without knowing it, regulate our body temperature and other functions. "People alter their behavior in response to the implementation of health and safety measures," Wilde argued in his 1994

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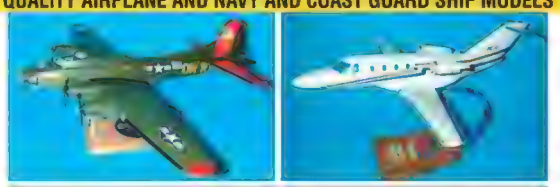
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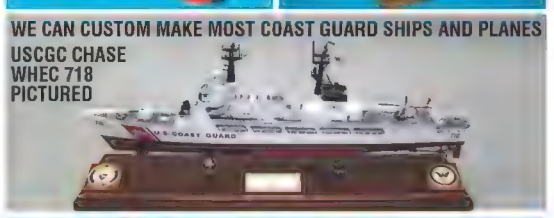
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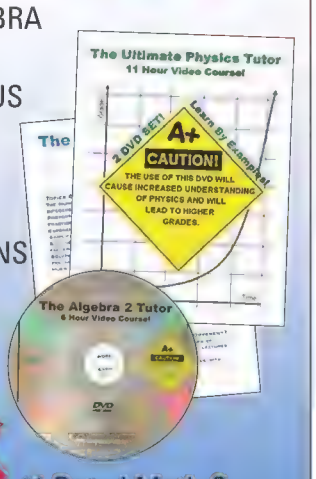
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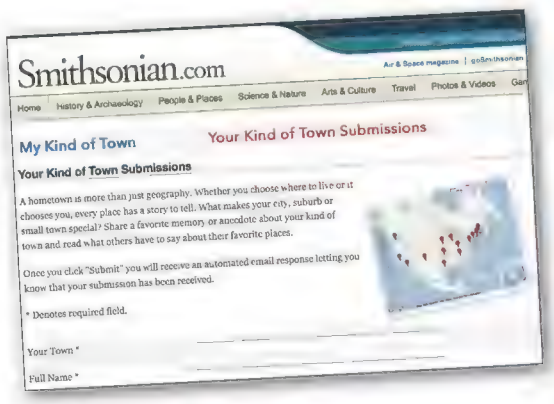
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Now there's a corollary: we don't simply tolerate risk; each one of us reduces—or increases—the perceived risk in any situation, depending on our inborn risk thermostat.

Studies suggest that children who wear protective sports gear play rougher.

book, *Target Risk*. "But the riskiness of the way they behave will not change, unless those measures are capable of motivating people to alter the amount of risk they are willing to incur." Or, to make people behave more safely, you have to reset their risk thermostats.

That, he says, can be done by rewarding safe behavior. He notes that when California promised free driver's-license renewals for crash-free drivers, accidents went down. When Norway offered insurance refunds to crash-free younger drivers, they had fewer accidents. So did German truck drivers after their employers offered them bonuses for accident-free driving. Studies indicate that people are more

DAVID BROOKS / CORBIS

likely to stop smoking if doing so will result in lower health and life insurance premiums.

Wilde's idea remains hotly disputed, not least by members of the auto-safety establishment. "Wilde would have us believe that if you acquire a brand-new car with air bags, you will decide to drive your new car with more reckless abandon than your old one," says Anne McCartt, a senior vice president for the Insurance Institute for Highway Safety, a nonprofit organization funded by auto insurers. "You will be unconcerned that your more reckless driving behavior will increase the chances of crashing and damaging your new car because returning to your previous level of injury risk is what you really crave! Only abstract theoreticians could believe people actually behave this way."

Still, even the institute acknowledges that drivers do compensate for risk to some degree, particularly when a safety feature is immediately obvious to the driver, as with anti-lock brakes. But seat belts? No way, says McCartt. "We've done a number of studies and did not find any evidence" that drivers change their behavior while wearing them.

Questions over risk compensation will remain unresolved because behavioral change is multidimensional and difficult to measure. But it is clear that to risk is human. One reason Homo sapiens rules the earth is that we are one of history's most daring animals. So how, then, should we mark the 50th anniversary of the seat belt?

By buckling up, of course. And by keeping in mind some advice offered by Tom Vanderbilt in *Traffic: Why We Drive the Way We Do (and What It Says About Us)*: "When a situation feels dangerous to you, it's probably more safe than you know; when a situation feels safe, that is precisely when you should feel on guard." Those are words even the parachutists, wilderness hikers and investors among us can live by.

WILLIAM ECENBARGER *is a former contributing editor for* Reader's Digest.

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According to scientific research, people can listen to a brain-fitness computer program to help rebuild brain matter that has turned flabby with age. Their findings indicate that the brain can reshape itself based upon the data it receives from a person's thoughts.

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It is commonly thought that the brain is the body's computer, receiving data and acting on it accordingly. Wetherill defined the process as *right thinking causes right results, whereas wrong thinking causes wrong results.*

People's brains function that way because ***whoever or whatever is the creator*** provided natural laws to enable human beings eventually to evolve into the kind of beings intended by that creator.

Today, natural laws are known as laws of physics, but there is also a behavioral law identified by Wetherill. He called it the ***law of absolute right***. It states: ***Right action gets right results; wrong action gets wrong results***, and it defines right action as rational and honest responses to whatever happens.

As with all natural laws, our ***results*** tell us if we are conforming to the behavioral law or contradicting it.

Originally that was the most unpopular information ever presented to a society that, from the beginning, established the practice of blaming wrong results on other people, bad luck, and later on, life styles, faulty diets and inherited genes—almost never on self.

It is widely known that laws of physics make mandatory people's physical activities. Thus they learn not to touch live wires, not to speed across an oil slick, and that gravity keeps pedestrians tethered to the earth.

But, lacking the knowledge of nature's ***law of right behavior***, society still believes that suffering and even death are the inevitable plight of mankind.

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As far back as the 1960s, behavioral experts declared this information too simplistic and unworkable while, at the same time, surreptitiously inserting parts of it into their own programs.

Do not be deterred by differing expert opinions. Learn about the behavioral law. Conform to it, not to benefit you (although it will) but to do what is right because that is what nature's behavioral law calls for. If that is your approach, you will be astonished by the results. If you are not astonished, be sure you are conforming to creation's law of absolute right with the same eagerness as you conform to creation's law of gravity.

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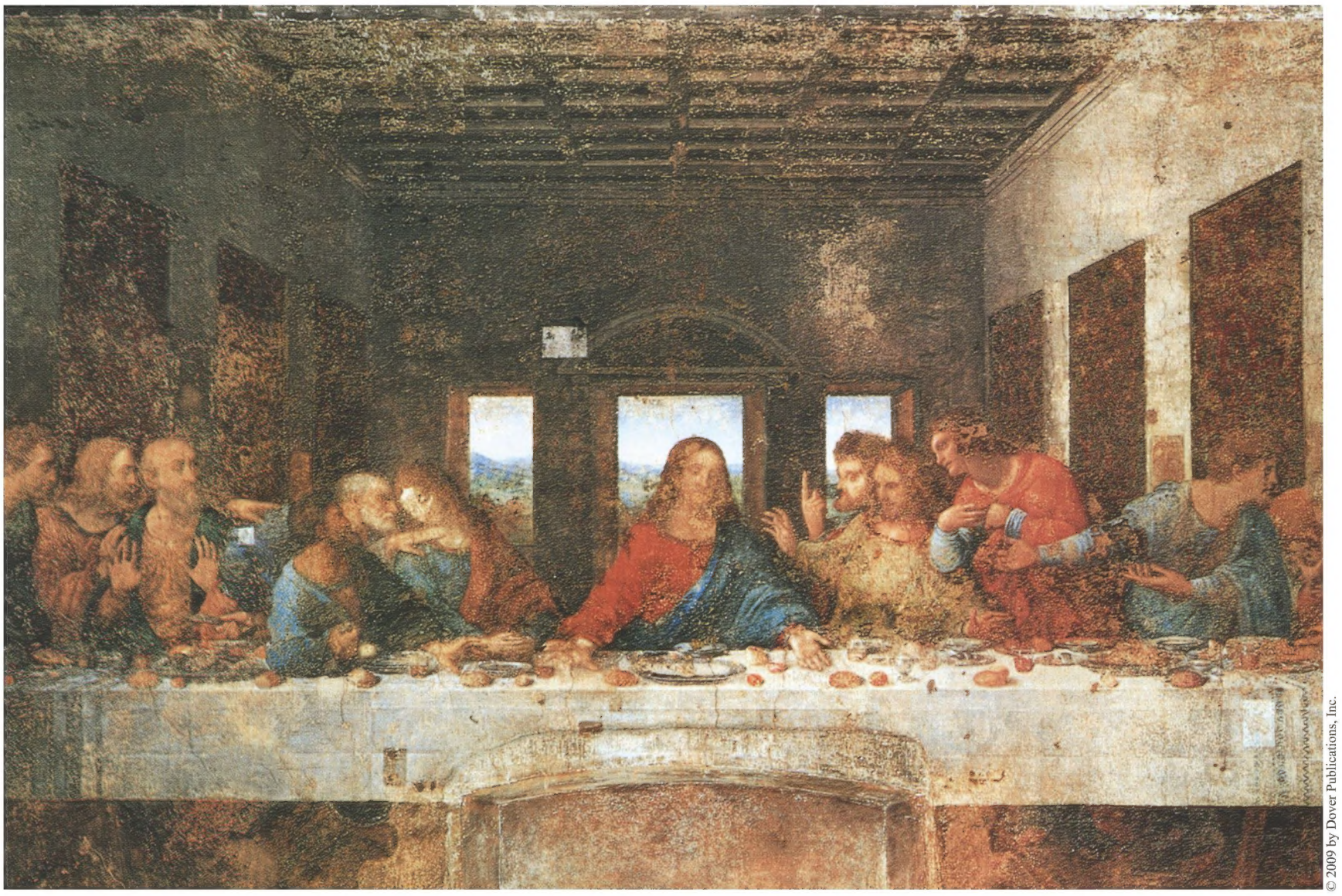

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Do Not Go Gentle

The feisty man's guide to aging anything but gracefully **BY ROY ROWAN**

SHE WAS SO PRETTY, her face etched in sadness peering out the window of the bus. I guess my admiring stare caught her by surprise, because suddenly her face brightened, she stood up and offered me her seat.

"Really, do I look that old and tottery?" I thought. No woman had ever done that before. And why should they? My barber tells me my hair is thicker than most guys half my age. Even my kids believe I'm still sharp enough to conquer all the electronic equipment they give me for Christmas. And it wasn't that long ago that these two legs I'm standing on carried me through all twenty-six miles, three hundred and eighty-five yards of the New York City Marathon.

"Please," the young woman said, smiling and pointing to her vacated seat. Not a sexy come-hither smile, but a benign half-smile reserved for men rendered harmless by their advanced years. Again I thought, "Do I really look so non-threatening? How would she have reacted if I had said, 'Thanks, but why don't we get off this rattletrap and go have a drink?'"

Was it pride or plain stubbornness that kept me from accepting the proffered bus seat?

Perhaps there's a more subconscious reason: a need to stand up for older age as a vibrant and productive time of life. So many of my contemporaries have given up and let themselves disintegrate during what they facetiously call their "golden years." And for some reason they seem to take pride in enumerating their ailments in what some wag called "organ recitals."

"Why don't you slow down and enjoy life?" friends keep asking. "Actually, I have," I tell them. "I walk instead of jogging, write articles without crushing deadlines and delight in spending hours sprawled on the floor letting my 8-year-old grandson teach me how to build towering structures with his Legos." But as for enjoying life, those well-meaning friends don't understand that for me, it's a matter of doing the things I've always done. More slowly, for sure, but more thoughtfully too, often mixing reminiscences with the job at hand.

My heroes are the two Pablos—Picasso and Casals—who pursued their painting and cello-playing well into their 90s; not the corporate titans whose golden parachutes landed them safely inside gated communities for unbroken days of golf, bridge and sunsets seen through a martini glass. Or voluntarily inhabit one of the 36,000 retirement communities with bucolic names like Sterling Glen, Pleasant Valley and Meadow Ridge. "Live the dream, an uncompromising lifestyle awaits you," one of their promotions promises. As far as I'm concerned, they can keep on waiting.

I still wonder why that young woman gave up her seat. It's not as if our bodies bear visible proof of our years like a tree's cambial rings or a male elk's antlers. And I'm not convinced that I really am all that old. I take heart in clichés such as "age is only a number" (my wife's, by the way, is unlisted). Of course, down deep I know our biological clocks keep ticking. Even so I'd like to think that ageless philosopher Satchel Paige had it right when he asked, "How old would you be if you didn't know how old you was?"

ROY ROWAN *is writing a book about making the most of old age.*

ERIC PALMA